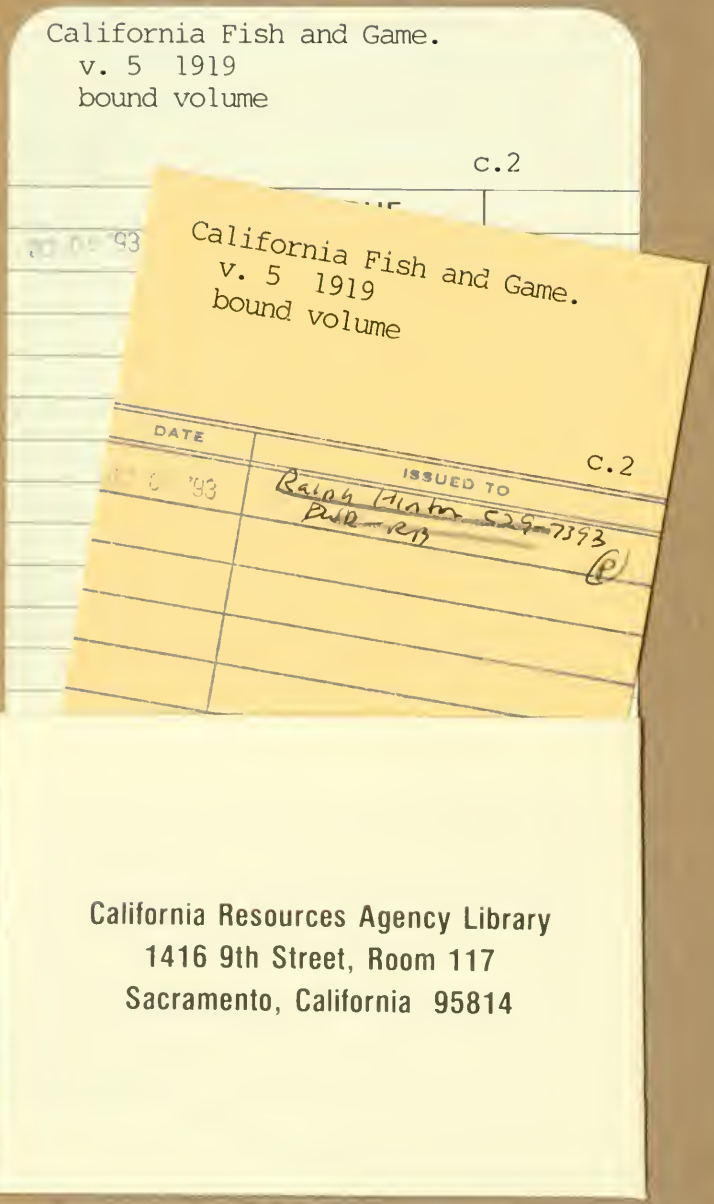

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CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

Volume 5 SACRAMENTO, JANUARY, 1919 Number 1

CONTENTS.

		Page
SHRIMP FISHERIES OF CALIFORNIA	*N. B. Scofield*	1
THE FISHES OF THE CROAKER FAMILY (Sciænidæ) OF CALIFORNIA	*E. C. Starks*	13
NOTE ON THE SAND DAB	*E. C. Starks*	21
THE STICKLEBACK: A FISH EMINENTLY FITTED BY NATURE AS A MOSQUITO DESTROYER	*C. L. Hubbs*	21
EARLY STAGES OF THE SPINY LOBSTER	*W. L. Schmitt*	24
THE COYOTE AS A DEER KILLER	*E. V. Jotter*	26
EDITORIALS		30
FACTS OF CURRENT INTEREST		36
HATCHERY NOTES		37
COMMERCIAL FISHERY NOTES		39
CONSERVATION IN OTHER STATES		42
LIFE HISTORY NOTES		42
REPORTS—		
Fishery Products, July to September, 1918		44
Violations of Fish and Game Laws		46
Seizures		46
Financial Report		47

SHRIMP FISHERIES OF CALIFORNIA.

By N. B. SCOFIELD.

As the question of removing the restrictions on the Chinese shrimp or bag nets periodically arises at each session of the legislature, it is thought best to give a brief history of the shrimp fishery in the state and to describe the fishery as it has existed in the past in order that those who care to can learn of the great destruction to young fish and young shrimps by the Chinese method of fishing.

The only account of the earliest shrimp fishing operations in the state is supplied by Mr. A. Paladini, the venerable fish dealer of San Francisco. He came to San Francisco in 1869 and engaged in shrimp fishing. There were eight boats on San Francisco Bay engaged in this

business, each boat manned by white men. They easily caught enough shrimps to supply the demand, besides many flounders, sole, tomcod, etc., for the fresh fish market. Fish and shrimps were very plentiful in the bay at the time. The shrimps caught were the same species as now, but were much larger than those caught in later years during the intensive fishing by the Chinese. This later reduction of the larger and older shrimps as noted by Mr. Paladini is good evidence that the shrimps were being subjected to overfishing. The early fishing of the eight boats of Italian fishermen was carried on with small-meshed seines, sixty feet long and eight feet deep, with a bag at the center. They used the nets in the deeper water of the bay for there the catch was freer of young fish and of the small unmarketable shrimps. The manner of fishing was to lay out the net, then anchor the boat down the tide and pull the net along the bottom toward the boat by means of lines, always pulling with the tide. The net was pulled directly into the boat. They would make from three to five hauls on each tide and they caught from fifty to seventy-five pounds of shrimps at a haul. This method of fishing was far less destructive to young fish than that employed later by the Chinese. They could fish in deeper water, where young fish and young shrimps were fewer, and unlike the Chinese nets which are set during the whole tide and kill practically all the young fish caught, they were in the water only a short time—less than one-half hour—and the small per cent of young fish caught were still alive and could be returned to the water. The shrimps thus caught were sold fresh at the Long Wharf. Little thought was then taken as to whether a method of fishing was destructive or not and there were few laws protecting fish, for it was thought that the supply of fish in the bay and rivers was inexhaustible. The Chinese had for some years been in the fishing business and with their destructive methods of fishing had already begun the extermination of the Sacramento perch and with their fiendish sturgeon lines had inaugurated a method of fishing that has resulted in the commercial extinction of that valuable fish which in the early days was here in apparently inexhaustible numbers.

In 1871 the Chinese began fishing for shrimps and introduced the destructive Chinese shrimp net. They made enormous catches with these fine-meshed set nets and found it profitable to supply the markets with shrimps at one and one-half cents per pound. The original eight Italian shrimp boats were driven out of business and since that time shrimp fishing has been almost entirely carried on by Chinese. From the very start the Chinese dried the bulk of their catch for the Oriental export trade. The shrimp fishery quickly grew to large proportions and fishing was carried on at many places in San Francisco Bay and in Tomales Bay in Marin County.

The first printed account of the shrimp fishery is contained in Vol. II of "History and Methods of the Fisheries" by Goode, printed in 1885 by the United States Bureau of Fisheries. A more extensive investigation of the fishery was made by the author for the California Fish and Game Commission in 1897. A subsequent investigation was made by the author in 1910. There has always been serious objection to the Chinese method of catching shrimps, and much of the legislature's time has been taken up by listening to discussions between those who would

conserve the fisheries resources of San Francisco Bay and rivers, on the one hand, and the interested defenders of the Chinese, on the other. Closed seasons were finally resorted to and the drying of shrimps was prohibited, without greatly reducing the destruction of young fish. At the 1910–1911 session of the legislature the use of Chinese shrimp nets was prohibited entirely. The shrimps had been so reduced in numbers that it was found unprofitable to catch them by the method formerly employed by the Italians. It was also found to be unprofitable to employ the shrimp trawl which was in successful use on Puget Sound. In 1915 the legislature removed the restriction against the Chinese net in South San Francisco Bay on the ground that in that part of the bay the destruction to young fish was much less than in the upper bay and for the further reason that in that part of the bay the kinds of fish destroyed did not include the young of herring, smelt, shad and striped bass as was the case in the upper bay. At the 1916–1917 session of the

Fig. 1. Chinese shrimp fishing junk on San Francisco Bay. Photograph by H. B. Nidever.

legislature a very strong effort was made to reestablish the fishery in the upper bay by those who would be benefited in the way of rents, selling of supplies, etc., and by those who would have the picturesque industry for sentimental reasons. As this effort is sure to be resumed at the 1918–1919 session it is believed an intimate description of the industry as it existed up to the year 1910 will be of interest, especially as the Chinese now operating in South San Francisco Bay are using identically the same methods, with the single exception that they do not catch so many young fish in that part of the bay and the young fish caught are not of the more valuable species.

Camps: The fishing has been carried on by what has been termed "camps." Each of these camps is a separate unit, which has its own boat, wharf, boiling vat and drying ground, separate living quarters and storehouses. Although one Chinese company may have owned or controlled several camps, even side by side at the water's edge, they

did not co-operate in any way. The camps were very similar in character, consisting of a group of small, rude shacks of rough, unpainted boards, placed near the edge of the water, with a rough wooden wharf running out into the shallow water on hand-driven piling which answered as a landing place for the camp's junk. Very few of the camps could be approached at low tide, for which reason they usually fished the flood tide in order that they might more easily bring their catch to the landing. The shacks which constituted the living quarters and storehouses were, in the majority of cases, crowded on a narrow beach between the water and the hills. The dry grounds of each camp covered about an acre of the slope of the hills for the want of a better

Fig. 2. Scenes on board Chinese shrimp junk on San Francisco Bay. Photographs by H. B. Nidever.

place, and were usually floored with boards. In two or three of the camps the drying ground was partly on a platform built out over the water. In 1897 there were 26 camps operating on San Francisco Bay and in 1910 this number had been reduced to 19. The camps on Tomales Bay were abandoned some years prior to 1897. Of the 19 camps found in 1910 three were in the cove just above South San Francisco, five were at Hunter's Point, four in Contra Costa County south of Point San Pablo in Marin County. The three camps near South San Francisco were controlled by one company, the Fook On Lung Company of San Francisco. They furnished no fresh shrimps for the market but dried their entire catch. Their fishing ground was in Alameda County about three miles east of San Bruno Point. Each

of their three junks used sixty Chinese shrimp nets such as are described under "Methods of Operating Nets." Two of the five Hunter's Point camps, located on the south side of the point, were owned by the Quong Lee Chong Company of San Francisco. Each of the two boats fished forty nets and they dried their entire catch. Their fishing ground was about a mile off shore, a little west of south from the point, which brought them within San Francisco County. Of the three camps on the north side of the point, the two camps nearest the point were controlled by the Fook On Lung Company, also known as the California Shrimp Company. The third camp on the north side of the point belonged to the Union Shrimp Company, a Chinese company of San Francisco. The three last-named camps sent part of their catch to the fresh shrimp market and dried the rest. They fished in Alameda County a mile south of the Alameda mole. The four Red Rock camps were located in a cove on the Contra Costa shore about two miles to the south of Point San Pablo. These camps belonged to the Union Shrimp Company of San Francisco and their four boats fished just to the north of Red Rock in water from four to six fathoms deep. This depth is greater than that fished by any of the other boats and it was not possible for them, on account of the depth and tide, to use more than thirty nets to each boat. Part of their catch went to the fresh market but the main part was dried. Of the seven camps near Point San Pedro, Marin County, one was situated in the first cove to the south of the point near the rock quarry. It was an independent company drying most of its catch but selling a few to the Union Shrimp Company, for the fresh market. Their boat fished about one-half mile southwest of the point. The next camp to the north of the point belonged to the Union Shrimp Company. Its boat fished about one-half mile off shore and sometimes across the channel in Contra Costa County. This camp sent part of its catch to the fresh market but dried most of it. One-half mile further to the north was a Quong Lee Chong Company camp and next to it in the same cove a Quong Sing Lung Company camp, while just to the north in the next cove was a second camp of the Quong Sing Lung Company and next to this two other Quong Lee Chong camps. These last five outfits named, dried their entire catch and their five boats operated sixty nets each. They fished far out on what is known as the "Petaluma Flats," the furthest boat fishing one-half mile due south of the outer Petaluma Creek Beacon, the other near but to the southwest. All five fished within the county of Marin.

The following description of the boats, nets and fishing methods applies to the industry today just as it does to the industry as it existed twenty years ago:

Boats. The boats used by these camps are of Chinese pattern and make. They vary in size, but the majority are about fifty feet long and twelve feet beam, with rounded bottoms without a keel, and with square sterns and rather blunt bows. They have one mast which carries a Chinese cleated sail. About fourteen feet of the stern is decked in and constitutes the living quarters of the crew. This compartment is entered through a small sliding hatch and there the five men of the crew cook their meals, eat and sleep. Just forward of this is the open shrimp locker, about twelve feet square, for holding the catch, and next forward is a locker of similar size for holding the nets.

The remaining space forward is used for lines and gear. On the deck between the crew's quarters and the shrimp locker is a crude wooden windlass placed horizontally and with four wooden spokes projecting by which it is turned by the hands and feet of the operator. From the drum of this windlass a line passes forward through a notch in the elongated bow post of the boat. This windlass and line is used to lift the series of nets from their fishing position at the bottom of the bay. The boats are of sufficient size to carry sixty wet nets and ten to twelve tons of catch.

Nets. Each separate net is constructed in the shape of a funnel. They are usually thirty-two feet long, with the larger opening or mouth about eighteen feet in diameter, from which the net tapers to the narrow opening a foot and one-half in diameter at the end of the sack. This narrow or cod end of the net is closed by a string which can be untied to remove the catch when the nets are pulled up. The nets are made in China from a very strong and durable twisted grass-like fibre. The net has a mesh of three and one-half inches near the mouth but the size rapidly diminishes toward the small end until the sack has meshes of one-half inch or less. This small-meshed end of the net, which has to sustain the weight of the catch when the net is pulled from the water, is usually reinforced by a net of coarse twine placed around the outside. In making the webbing of these nets square knots are used instead of the usual knot used by fishermen the world over. The nets are dried and tanned about once a month and with care they will last a year. Their cost is about $25 Mexican in China. After paying freight and other charges and adding the hanging line around the larger opening they cost here about the same amount in gold.

Method of Operating Nets. Each junk operates a set of nets, thirty to sixty in number, which are set side by side at the bottom of the bay with their larger openings or mouths open to the current. The nets are held in place by a series of brails or spreaders—2x3 inch sticks of pine five feet long—each of which is held to a short stake driven in the bottom of the bay by a line from either end, of sufficient length to permit of the brails with the nets attached being lifted to the surface during the slack water between tides, without detaching them from the stake. The stakes to which the brails are attached are driven twenty-four feet apart across the current in the muddy bottom of the bay in a very ingenious manner. For driving these stakes a very long tapering pole is used with a four-inch iron pipe fitted on the larger end so that a hollow end of the pipe projects a couple of feet beyond the end of the pole. Selecting a stake with lines and brail attached, its head is inserted in the hollow end of the pipe where it fits loosely but is kept from falling out by holding on to the brail lines while the pole is held in the vertical position over the spot where it is to be driven. The pole with the stake in place is then lowered from the boat until the stake is pressed into the mud. The stake is then driven home by repeatedly lifting the pole a short distance and then lowering it forcibly. The stakes are driven twenty-four feet apart across the current so that each brail when it is in position with nets attached will stand vertically on the bottom in each space between the mouths of the nets. Attached in this way, the net mouths instead of being circular are now rectangular in shape, the opening being twenty-four feet across and about four and one-half feet

deep. To remove any uneven strain on the nets and to prevent their being carried away by the swift tide, a heavy anchor or stake is placed about fifty feet out from each end of the row of stakes and in line with them, from which runs a heavy line which is tied with a clove hitch to the center of each of the brails. By anchoring this heavy line in line with the stakes and sufficiently far out, the arrangement does not interfere with lifting the brails and nets to the surface of the water when the catch is to be removed just before the slack water at the end of the tide. Besides the heavy anchor line running from brail to brail, there is another and lighter one, the buoy line, which facilitates in lifting the nets. This line, when the nets are set in fishing position, extends from a floating buoy at one end of the string of nets to the first or end brail, to which it is tied by a bight about a foot from its top. From thence it runs to each brail in succession until the last brail at the end of the string of nets is reached, from whence it extends up to another buoy on the surface of the water. This buoy line is in place only when the nets are set. The nets are fastened to the brails

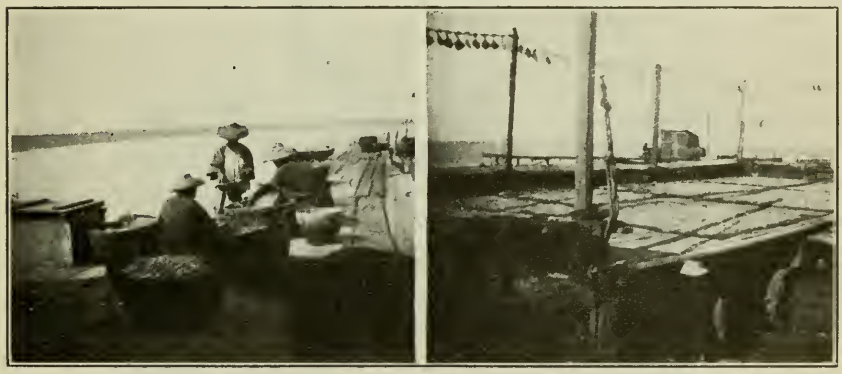

Fig. 3. Sorting and drying young fish obtained from shrimp nets, Point San Pedro, 1897. Shrimp fishing endangers the fisheries by destroying young fish. Photographs by N. B. Scofield.

and the buoy line is attached just after the turn of the tide before the current has become swift. The force of the current swings the series of nets down onto the bottom where they are held by the brail lines to the row of stakes, reinforced by the heavy anchor line. Here they are left during the entire tide, the time varying from four to eight hours, with their mouths open against the tide while the current carries the shrimps and young fish into them. With this manner of fastening the nets they can be used on either a flood or ebb tide.

When the nets are to be lifted at the end of the tide after the force of the current has slackened sufficiently, an end of the buoy line is taken at one of the buoys, passed through the notch in the bow post of the boat and thence carried back to the windlass, where it is reeled in by one man, thus bringing the first brail to the surface and lifting the net with it. The other members of the crew detach the net and the buoy line from the brail while the man at the windlass reels up the next brail. Thus the nets are detached in succession, the catch being emptied into the shrimp locker and the nets placed in the net locker. The

Chinese are very expert in handling the nets and work rapidly, each man with a particular duty to perform. The time in which the nets have to be lifted is limited usually to about half an hour. They can not begin sooner for the nets can not be lifted when the current is strong. If they are not gotten out before the tide turns the nets begin to swing the other way and they become tangled and the catch is lost. When tides are so strong that there is danger of carrying the nets away they reduce the current pressure by tying the upper edge of the nets farther down on the brails. If the tides are extremely swift they reduce the number of nets.

Shrimp Drying. After the nets are all lifted the junk sails back to the dock at its camp, where the catch is carried in baskets, Chinese

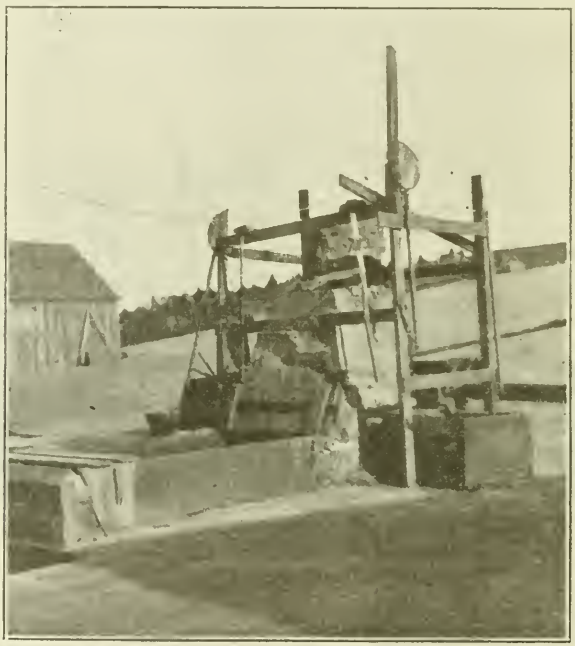

Fig. 4. Shrimp boiling vat, showing skimmers and rakes hanging on crude chimney. Point San Pedro, 1910. Photograph by N. B. Scofield.

style, to the boiling vat. This vat is about four by eight feet and eighteen inches deep, with wooden sides, the bottom being of sheetiron bent up around the sides. It is built in with bricks and mud and to heat the water both wood and coal is used. Fresh water to which rock salt has been added is used in the vats. The shrimps, together with the fish caught with them, are poured in, ten or twelve baskets at a time, and boiled from ten to fifteen minutes. They are then dipped out with a strainer and put into baskets to be carried to the drying ground. Here the shrimps and fish, the latter usually small and delicate with the flesh boiled from the bones, are spread out together to dry in the sun. When the weather is good the shrimps will dry in about four days, when they are gathered together and rolled with elevated, wooden rollers

to break the shells from the meats. The whole mass is then carried to a shed where it is run through a small fanning mill to separate the loose shells, fish bones and pulverized fish flesh from the heavier shrimp meats. By screening and hand picking the shrimp meats are divided into two grades, the unbroken meats in one and the broken meats in the other. They are then sacked, 280 pounds to the sack. The shells, fish-bones and fish flesh, and all fine particles and dust are saved and put in sacks, 310 pounds to the sack, and sold for use as a fertilizer. The loss in drying is about 65 per cent, and for each pound of shrimp meats there are two pounds of fertilizer or "shells."

Drying Fish. The amount of young fish taken in the Chinese nets is always large, varying from 10 to 75 per cent of the entire catch. Formerly large quantities of these fish were dried. The larger fish were picked out and hung on strings to dry while the very small fish, principally the young smelt (*Osmerus thaleichthys*) were dried on trays which had been covered with discarded net webbing. The small fish were separated from the shrimps by dumping a basket of the catch in a small vat of cold water where the live shrimps sank to the bottom, thus allowing the small dead fish to be easily skimmed from the top. After being prosecuted for catching young fish they ceased to dry the small fish and boiled them with the shrimps to get rid of the evidence as quickly as possible. They were nearly as valuable as a fertilizer as they were as a food product. There has always been this incentive to catch the young fish and experience has shown that it is impossible to operate the Chinese net without catching great quantities of immature fish, thus causing great damage to the fisheries of the bay and rivers.

Fresh Shrimps. In the camps that sent fresh shrimps to the markets they had a special shed at the wharf where part of the catch was taken and the larger shrimps screened out by hand and all fish, seaweed and dirt carefully picked out. The shrimps for the market were boiled before the rest of the catch, in the same way as were those to be dried except that less salt was used and they were not boiled quite so long. After boiling, the shrimps were spread on matting on the sorting room floor where they could cool and the surplus moisture evaporate. They were then placed in baskets and conveyed by power launch to San Francisco.

Three Species of Shrimps. Three species of shrimps are taken in San Francisco Bay. Fully 90 per cent of them are of one species, *Crago franciscorum*. The remaining 10 per cent is made up of the two species, *Crago nigricauda* and *Crago nigrimaculata*.

The shrimps drift back and forth along the bottom of the bay with the tides but have the power in some measure to select their environment, for in the winter time when the fresh water is entering the bay in larger quantities they move farther down the bay. In the summer when the blue sea water encroaches on the flats they move farther up toward the river mouths. They appear to go on the shallower flats when they are carrying their eggs. The smaller individuals are found mostly in shallow water and in the deeper and swifter water more large ones are found. They have a wide range, however, for they are found in the deepest water as well as the shallowest and can be found in water perfectly fresh as well as in pure sea water. Very little is known about their life history. Females may be found carrying eggs attached to

her swimmerets at all seasons of the year. From evidence that has been gathered it is certain that the eggs are carried at least two months on the outside of the body before they hatch and the life of the shrimp from the egg through one spawning time is not less than two years. They feed on minute animal and plant life at the bottom. They may at times feed near the surface for they can swim rather rapidly through the water, moving with the head first.

Character and Quantity of the Catch. The catch of one junk for one tide varied from ten hundred pounds to ten tons. An average day's catch for the boats using forty nets was six thousand pounds and for the boats using sixty nets, eight thousand pounds. The nets always contain young fish, the quantity varying from 10 per cent to 75 per cent of the entire catch. The boats using sixty nets each on the shallow flats on the west side of San Pablo Bay caught the greatest proportion of young fish. The reason for this is that most of the fish which enter San Francisco Bay enter for the purpose of spawning. Among these fish the valuable ones are the herring, smelt, striped bass, shad and salmon. Besides these the young of other valuable commercial species, such as the crab and the sole, enter the bay for the purpose of feeding and for protection. A bay with rivers entering it is always a nursery for young fish. Where there is an intermingling of fresh and salt water as in the upper San Francisco Bay there is a prodigal growth of small animal life, including shrimps and other species of small crustaceans. Upon this small life the young fishes feed. The young fish are there because the shrimps are there. A method of shrimp fishing such as that employed by the Chinese, which catches the young fish as readily as the shrimps and holds them until they are suffocated, is a serious menace to the whole fishing industry of the bay and its tributary rivers. Even if they caught only shrimps, there is a limit to the number which should be caught for they are the food of our more valuable fishes, but when the method of fishing takes the young fish themselves in vast quantities, as did the Chinese nets in upper San Francisco Bay, it should not be tolerated if we value the other fisheries, or if we value the shrimp itself, for there is every evidence that even the shrimps were being overfished. To appreciate the seriousness of the situation as it existed in 1910, just imagine the nineteen Chinese junks with their combined nets numbering one thousand, each one having a mouth opening of 24x4½ feet, straining the small fish and shrimps from the rushing water, tide after tide. The total annual catch by the Chinese junks at the time they were stopped from fishing in 1911 was considerably in excess of ten million pounds of fresh shrimps and fish combined. Of this amount no more than eight hundred thousand pounds of the shrimps were used fresh. The rest was all dried and marketed as dried shrimp meat and fertilizer.

After the Chinese method of fishing was stopped it was found that the Italian method as employed in the early days was not profitable, for the shrimps were too scarce and there were no more flounders or tomcod. Neither was the shrimp beam trawl profitable for the shrimps were not plentiful enough for that method and the nets were torn on the Chinese shrimp stakes driven all over the bay. As no other method of catching shrimps was employed and as the market was bare of shrimps, the

presence of which had been for years a feature of California, the ban was lifted from the Chinese nets in southern San Francisco Bay in 1915. The nets do less damage in that part of the bay as there are fewer young fish there of valuable varieties for the reason that there is little fresh water flowing in that portion of the bay. The young of the herring are not found there, as they spawn in the upper bay, nor are the young of the smelt, shad, striped bass or salmon found there, for they are hatched only in the larger rivers and as they descend to the bay they distribute themselves in the brackish water nursery of the upper or San Pablo Bay. Shrimps were not very plentiful in south San Francisco Bay on account of the former heavy fishing and on account of the gradually increasing salinity of the water. Drying of shrimps had also been prohibited and it was found not very profitable to fish for the fresh market only. During the first year after they resumed fishing the markets took less than 350,000 pounds of shrimps. They could have had more but there was not the former demand. The amount of

Fig. 5. Drying shrimps at Point San Pedro in 1910. Photographs by N. B. Scofield.

fresh shrimps marketed has increased each year until now the amount is equal to that of any former year when shrimp fishing was at its height. The shrimps have increased in numbers in all portions of the bays, as also have the number of small fish, especially the young of the striped bass. It has now become profitable to use the shrimp beam trawl which, towed with the tide, catches the shrimp with a very small per cent of young fish. As illustrative of the damage done by the Chinese nets in former years the following is quoted from my note book of 1897:

> "The average catch per day for each boat at the San Rafael (Point San Pedro) fishery, during the last two weeks of July, was seventy baskets, each basket weighing about ninety pounds, making in all six thousand three hundred pounds. The average number of boats out each day was seven, making in all a daily catch of forty-four thousand one hundred pounds. For thirteen days (the time they were under continual observation) this number is swelled

to six hundred sixty-one thousand, five hundred pounds. One-half of this catch consisted of small fish, the principal species being smelt, California anchovy and sculpin.

The small smelt, two and one-half to three and one-half inches long, were very abundant, making up over one-fourth of the entire catch. The estimated amount of these young smelt taken in the last fifteen days of July is 165,375 pounds, or about 16,537,500 small fish. When the nets are brought to the surface of the water, these small smelt are dead, so that to throw them back would do no good."

Later, in the year 1910, we made the following notes:

"*Oct. 25, 1910*: Visited two San Pedro Point boats as they lifted their nets. One had 30 per cent of young fish, mostly smelt and sole. They also had a good many undersized female edible crabs, which were alive, but they had not attempted to throw them back. The other boat had 20 per cent of young fish.

Oct. 28, 1910: Six boats out of San Pedro Point. Ming's boat had eighty baskets on this tide, of which 30 per cent was fish, mostly young smelt, young sole, and tomcod. One boat had forty baskets, two boats fifty baskets each, and the remaining two had seventy-five each. The amount of young fish was about 20 per cent. Ming says he uses forty nets and has averaged seventy baskets a day for September and October. The five camps above him use sixty nets each and their catch is much larger.

Oct. 29, 1910: Again visited San Pedro Point boats. Five boats out. The catch the same as yesterday. Three boat crews have been arrested in the last few days for catching young fish, but when visited yesterday and today they made no attempt whatever to throw back even the few fish that were alive. Wing had used a screen to get out the fish, but his catch was still 30 per cent fish. Their nets were all set wide open, as the tides are not so strong now."

The above notes are selected to give a conservative idea of what the average catch consists in upper San Francisco Bay. The greatest damage is done on the shallow San Pablo Bay flats. During the winter months large numbers of small striped bass are killed in the nets. The boats which fished below San Pablo Bay in the deeper water near Red Rock and the Stone Quarry caught smaller quantities of young fish than those above, but they caught more of the young striped bass than any others. The late increase in the number of striped bass is undoubtedly in large part due to the abolition of the Chinese nets in the upper bay, and if we value that fine food and game fish the destructive shrimp nets should be kept out.

The Chinese operating in South San Francisco Bay catch fewer young fish and the varieties caught are not of the valuable species. The lower bay can easily supply the fresh markets without serious injury to any of the other fisheries. But even there, the nets should be prohibited as soon as a less destructive method of shrimp fishing can be developed.

THE FISHES OF THE CROAKER FAMILY (SCIAENIDAE) OF CALIFORNIA.

By EDWIN CHAPIN STARKS, Stanford University.

The fishes of this family have a peculiar silvery skin that is unlike the bright, burnished silver of some fishes, the herrings for instance, but suggests rather frosted silver. The head is closely covered with scales, more or less irregular in size and shape, and the pore-bearing scales of the lateral line extend onto the caudal fin. The bones of the skull are variously excavated with tunnels and open channels (cavernous), and the chin is usually provided with large pores or barbels. Two dorsal fins are present; the first composed of spines and more or less triangular in shape. The anal fin has one or two spines, sometimes very small and slender or sometimes the second one is very much enlarged.

The croakers are carnivorous fishes rather distantly related to the basses. Many of them make a peculiar noise from which the common names of croaker, grunter, and drum have been derived. The noise is supposed to be made by forcing the air (or more properly, gas) from one part of the swim bladder to another. The species are numerous on sandy shores, and are most abundant in warm and tropic seas. At Panama, for instance, there are between 40 and 45 representatives of this family. Of the eight that occur on our coast only two are found in abundance as far north as San Francisco. Most of the others occasionally stray that far, but are common only on the southern coast. All of them are very good food fishes, and some are classed as game fishes.

The common or popular names of these fishes are even more mixed up and poorly applied than usual. *Cynoscion nobilis*, the "sea bass," is not a bass, and *Seriphus*, sometimes called the herring, does not even remotely resemble the herring. The young "sea bass" is known as "sea trout." No possible stretch of the imagination could make it suggest a trout, and having wrongly called its parent a bass, to call it a trout is a very good commentary on how loosely common names are used. *Genyonemus*, the fish that is usually known as the kingfish, is sometimes called "tomcod" on the southern California coast. It resembles a tomcod as little as *Seriphus*, the queenfish, resembles a herring. When *Genyonemus*, the kingfish, is called "tomcod" the name kingfish is transferred to *Seriphus*, the queenfish, or white croaker. *Cynoscion parvipinnis*, a close relative of the "sea bass," is sometimes called "bluefish," though it has nothing whatever in common with the famous bluefish of the Atlantic. The names croaker, roncador, and corvina are not at all consistently applied, but are shuffled back and forth between various of these fishes.

Hence in the use of vernacular names among these or any other fishes the reader is again cautioned that there is no constancy nor rule for their application, and he can only be sure of definitely indicating a given fish by using its scientific name. Though such names will probably never be used by people at large, and certainly not by unlettered fishermen, the scientific name is nevertheless the one true name for a species, and a name that will be recognized by scientific men in all countries the world over.

KEY TO THE FISHES OF THE CROAKER FAMILY IN CALIFORNIA.

1. Lower jaw projecting beyond tip of snout, which is sharp.

2. Base of second dorsal fin about equal in length to base of anal fin. *Queenfish or White Croaker. Seriphus politus.* Page 15.

2–2. Base of second dorsal fin very much longer than that of anal fin.

3. Teeth at middle of upper jaw little if any enlarged. Pectoral fin more than half the length of head. Its tip reaching about as far back as tips of ventrals. *White Sea Bass. Cynoscion nobilis.* Page 15.

3–3. One or two long teeth pointing backward at the middle of upper jaw. Pectoral fin less than half the length of head. Its tip not reaching as far back as tips of ventrals. *California Bluefish. Cynoscion parvipinnis.* Page 16.

1–1. Tip of snout blunt and projecting beyond tip of lower jaw.

4. A single short barbel or appendage at tip of lower jaw.

5. A large thick spine at front of anal fin. The first spine of the first dorsal not longer than the spines just behind it. The tip of the first dorsal rounded. *Yellowfin Croaker. Umbrina roncador.* Page 17.

5–5. No enlarged spine at front of anal fin. The first dorsal spine longer than the others, making the tip of the first dorsal very sharp. *California Whiting. Menticirrhus undulatus.* Page 17.

4–4. No single barbel at tip of lower jaw.

6. A large thick spine at front of anal fin.

7. A large black spot on front of pectoral fin. Pectoral fin as long as head, and reaching past tips of ventrals. Caudal fin concave behind. *Spotfin Croaker. Roncador stearnsi.* Page 18.

7–7. No spot at front of pectoral, but a dark spot usually present on hind edge of gill cover. Pectoral fin much shorter than head and not reaching to tips of ventrals. Caudal fin not concave behind. *Black, or Chinese Croaker. Sciaena saturna.* Page 19.

6–6. No enlarged spine at front of anal fin. *Kingfish. Genyonemus lineatus.* Page 20.

GLOSSARY.

Anal fin: The single fin on the lower side of the body towards the tail.

Barbel: A small fleshy projection or appendix. In these fishes it is on the lower jaw.

Caudal fin: The tail fin.

Dorsal fin: The fin on the back. In these fishes it is divided into two fins: the first composed of spines, and hence called spinous dorsal; the second composed of soft rays.

Maxillary: The flattened bone bordering the mouth above.

Pectoral fin: The pair of fins, one on each side, situated close behind the gill opening.

Preopercdum: A bone of the gill cover that borders the cheek behind. It is considerably in front of the hind edge of the gill cover, and has a free edge.

Snout: The part of the head that lies in front of the eyes except the lower jaw.

Ventral fins: The paired fins on the lower part of the breast; close under the pectorals in these fishes.

The Queenfish, or White Croaker (Seriphus politus).

The length of the base of the second dorsal fin is about equal in length to the base of the anal fin. The tip of the snout is rather sharp and the tip of the lower jaw projects beyond it when the mouth is closed. The mouth is long and narrow, and the maxillary does not quite reach to vertically below the hind border of the eye. The dorsal fins are well separated, and the spines of the first dorsal are slender. The color is bluish above with the sides and belly bright silvery, the fins yellow, and the base of the pectoral dusky.

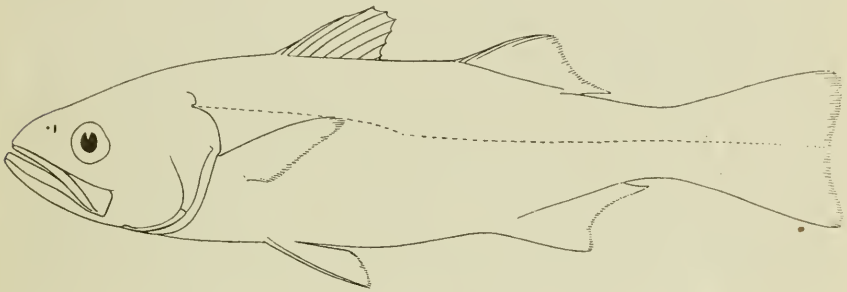

Fig. 6. The queenfish (*Seriphus politus*).

On the southern California coast this fish is ridiculously called herring, a name that should decidedly be discouraged, for it has nothing in common with the herring, is not related to it, and does not even look like it. It also in the same region shares with *Genyonemus lineatus*, the name of kingfish. The latter is almost universally so known and hence has the best right to the name.

This fish reaches a length of about a foot, and is an excellent pan-fish. It is salted and smoked to some extent in southern California and marketed as herring. It is common on sandy shores of the southern and Lower California coasts, and has been taken as far northward as San Francisco.

The White "Sea Bass" (Cynoscion nobilis).

The snout is sharp and the tip of the lower jaw projects beyond it when the mouth is closed, while the length of the base of the second dorsal is three or more times the length of the anal base. The length of the pectoral fin is more than half the length of the head, and the tip of the pectoral reaches about to opposite the tips of the ventrals. There are no greatly enlarged teeth pointing backwards at the front of the upper jaw. The mouth is large and the maxillary nearly or quite reaches to vertically below the hind border of the eye. The caudal fin

is concave behind. Very fine dark points are everywhere dusted over the silvery color, making it more or less dusky bluish. The inner surfaces of the pectoral and ventral fins are dusky.

Fig. 7. The white sea bass (*Cynoscion nobilis*).

Though this fish is only distantly related to the bass, it is in California almost universally known as the sea bass or white sea bass. On the Atlantic coast fishes of this group are known as weakfishes. This species is one of our most valuable food fishes, reaching a weight of 90 or more pounds, and having firm white flesh. It is found in considerable abundance along the California coast and southward to Lower California. It has been reported as far north as Puget Sound. The young has dusky bands extending down from the back onto the sides. Fishermen call the small ones sea trout.

The California "Bluefish" (Cynoscion parvipinnis).

As in the white sea bass the snout is sharp; the tip of the lower jaw projects beyond it when the mouth is closed; and the base of the second dorsal fin is much longer than that of the anal fin. It may be known from the white sea bass by the pectoral fin being less than half the length

Fig. 8. The California bluefish (*Cynoscion parvipinnis*).

of the head, and its tip not nearly reaching as far back as the tips of the ventrals. It is also distinguished by having one or two long sharp teeth pointing backwards from the middle of the upper jaw. The dorsal fins are close together. The color is steel blue above and silvery on the lower parts and sides.

This fish closely resembles the white sea bass—in fact it is not recognized as different by many fishermen. It does not reach as large a size,

probably not exceeding a couple of feet in length, and it is said to be much inferior to it. Its flesh is soft and it does not bear transportation well. It is found from southern California southward along the coast of Lower California.

The name bluefish as applied to this species probably is on account of its color, and not because it is thought to be the same as the famous bluefish of the Atlantic. The latter is a very different fish, not at all related to this species.

The Yellowfin Croaker (Umbrina roncador).

This fish may be known from its relatives by a short fleshy barbel, or appendage, that projects from the chin, and, in addition, by a large thick spine at the front of the anal fin. The enlarged spine is the second anal spine, there being a very short one in front of it. Its snout is blunt and projects over and above the tip of the lower jaw. The mouth is nearly horizontal, and the maxillary reaches to under the middle of the eye. The edge of the bone that bounds the cheek behind

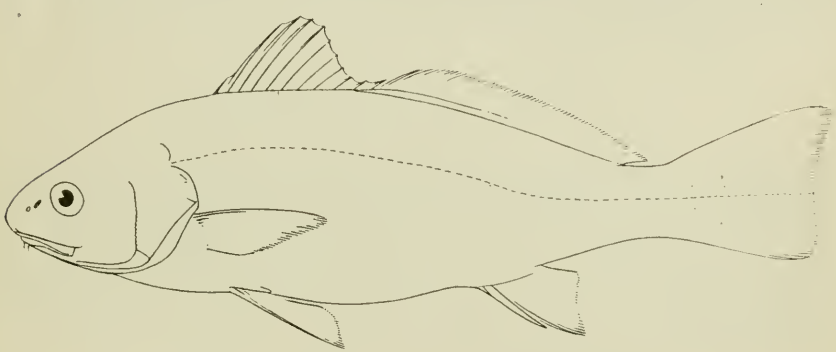

Fig. 9. The yellow-fin croaker (*Umbrina roncador*).

(preopercnlum) is set with fine spines. The spinous dorsal is triangular in shape but rounded at its upper angle at the points of the first spines. The pectorals are rather short and do not reach as far back as the ventrals do. The caudal is concave behind; and the upper lobe is longer than the lower. Brassy and golden reflections overlie the silvery color. The back is bluish, and over the back and sides are many wavy dark lines that extend upward and backward following the rows of scales. The fins are mostly yellow.

This fish reaches a length of 15 or 16 inches, and it is rather common on the southern California coast. Its range extends southward into the Gulf of California while an occasional one strays northward as far as San Francisco. It is a very good food fish, and is caught in considerable abundance by the anglers on the piers and beaches of southern California. It is a very handsome fish when it is first drawn from the water, but its iridescent colors soon fade.

The California Whiting or Corvina (Menticirrhus undulatus).

This is a well marked fish that may be known by a fleshy barbel, or appendage, that projects from the chin, the first dorsal spine longer than

the others, making the fin sharply pointed above, and the caudal fin with its lower angle rounded and its upper sharp. The barbel at the chin is longer than in the yellowfin croaker. It may be known from that species at once by its lacking an enlarged spine at the front of the anal. The upper jaw projects considerably over the lower, the mouth is horizontal, and the maxillary barely, or scarcely, reaches to below the front edge of the pupil. The edge of the preopercnlum is divided into fine points which are membranous and not bony spines as in the yellowfin croaker. The pectoral is rather long and reaches to about the tips of

Fig. 10. The California whiting (*Menticerrhus undulatus*).

the ventrals. The color is grayish with bright reflections. On the back and side are many dark wavy lines that run upwards and backwards. The back sometimes has faint dark bars crosswise to the body.

This fish is rather common on sandy shores of southern California, and is known southward into the Gulf of California, while individuals are sometimes taken as far northward as San Francisco. It is a very good food fish and reaches a length of 18 or 20 inches.

The Spot, or Spotfin Croaker (Roncador stearnsi).

This fish may be known at once by the large black spot at the base of the pectoral fin. It is not only on both sides of the pectoral, but is also somewhat on the body behind the pectoral base. As in most of the

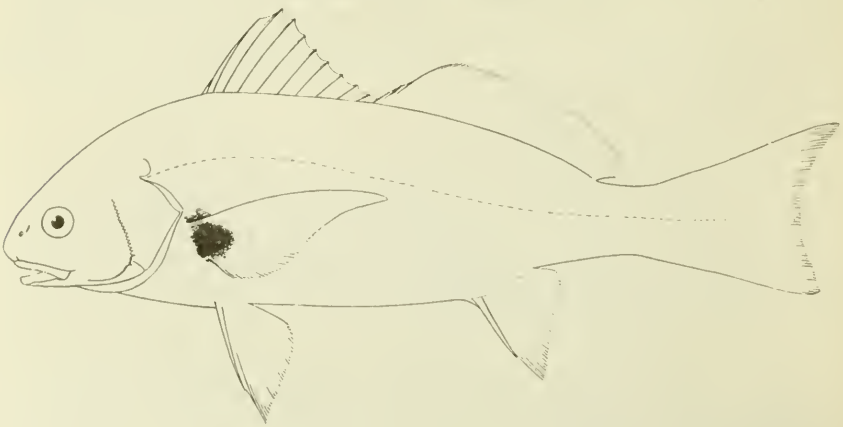

Fig. 11. The spot (*Roncador stearnsi*).

croakers, a blunt snout extends over a horizontal mouth. The mouth is moderate in size, and the maxillary reaches to below the middle of the eye. The preoperculum is set with fine sharp spines. The first dorsal has stout spines and the second spine of the anal is enlarged, the first spine being, as usual, small. The pectoral is as long as the head, and reaches considerably past the tips of the ventrals. The color is grayish silvery, lighter below. Wavy dark lines follow the rows of scales extending upwards and backwards. These are less conspicuous than in the yellowfin roncador. Two dusky streaks usually run back from the throat to the ventrals and thence to each side of the anal.

This fish is abundant on the southern California coast, and, like most of the others, has occasionally been taken as far north as San Francisco. It is of some importance as a food fish, and reaches a weight of 5 or 6 pounds.

The Black Croaker, or Chinese Croaker (Sciaena saturna).

The following combination of characters will identify this fish from its relatives: The snout blunt and projecting over the tip of the lower jaw; no barbel at the chin; the second anal spine large and thick; no

Fig. 12. The black croaker (*Sciæna saturna*).

black spot at base of pectoral; the pectoral shorter than the head and not reaching to the tips of the ventrals. The mouth is small, the lower jaw closes within the upper, and the maxillary reaches to below the middle of the eye. The scales on the head are small, rough and uneven. The preoperculum has a membranous edge that is divided into very fine points which are scarcely noticeable without the aid of a magnifier. The dorsal spines are rather stout, but not nearly so stout as the second anal spine. The caudal is slightly convex, or with its middle rays the longest. The color is dusky with reddish coppery reflections. A pale band usually extends downward from between the dorsals to opposite the tips of the ventrals. This often fades with age. The lower parts are silvery but dusted over and obscured by dark specks. The side of the head is more brilliantly coppery color than elsewhere. The ventral fins are dusky or black. A black spot is present at the edge of the gill cover just above its angle.

This fish has not been reported north of Santa Barbara. Its range extends southward alonge the coast of Lower California. It reaches a length of about 15 inches, and is a fairly good food fish.

The Kingfish (Genyonemus lineatus).

The characters of the first sentence separate this fish from its relatives. The blunt snout projecting over the tip of the lower jaw; no barbel at the chin; no enlarged spine at the front of the anal. The mouth is rather oblique. The lower jaw closes within the upper, and the maxillary reaches to under the middle of the eye or a trifle farther. The edge of the preoperculum is membranous and without fine bony points. On each side of the lower jaw just behind the chin are several very small barbels, so small that they scarcely show without the aid of a magnifier. The spines of the dorsal are slender. The pectoral ends opposite to the very slender points of the ventrals, or reaches a little past. The caudal fin is slightly concave behind. Brassy reflections

Fig. 13. The kingfish (*Genyonemus lineatus*).

overlie the bright silvery color. Very faint wavy lines follow the rows of scales upwards and backwards. The fins are usually yellowish, and there is a small dark spot just behind the base of the upper pectoral rays.

This fish and the white sea bass are the only ones of this family that are found in any abundance as far north as San Francisco. It runs southward along the Lower California coast. It is commoner in summer than in winter, and more abundant on the southern coast than the northern. It scarcely exceeds a foot in length, but its abundance makes it a food fish of considerable importance. When fresh it is a very good food fish, but its flesh is rather soft and it does not keep very well. It is sometimes called tomcod in southern California. This name should not be used, for it in no way, shape, nor manner resembles the tomcod.

NOTE ON THE SAND DAB.

By EDWIN C. STARKS.

Through an oversight in the paper on flat-fishes that appeared in the last number of California Fish and Game the old name of soft flounder was used as a common name of the fish that has in recent years been known as the sand dab (*Citharichthys sordidus*). This name, sand dab, has almost entirely supplanted the older name on our coast and for that reason should be used. It is, however, one of those unfortunate names borrowed from another fish from another part of the world. The sand dab of the Atlantic coast (*Hippoglossoides platessoides*) has the best right to the name, for it was first so called. It bears little resemblance to our sand dab. So in your copy of California Fish and Game please write sand dab in place of soft flounder.

THE STICKLEBACK: A FISH EMINENTLY FITTED BY NATURE AS A MOSQUITO DESTROYER.

By CARL L. HUBBS.

Since it has been proved that malaria, yellow fever, and other dread diseases are carried by mosquitoes, there has developed a wide interest in these little insects, which hitherto had been regarded more as a nuisance than as a menace. Many studies have been undertaken in order to determine the best methods by which mosquitoes may be exterminated or at least greatly reduced in numbers.

The use of window screens, the draining of swamps, and the oiling of waters, as well as the spread of natural enemies, are methods of control that have received attention with very notable success. For instance, the building of the Panama Canal has been made possible by the destruction of mosquitoes and the consequent control of yellow fever.

A word as to the main methods of mosquito control. The use of screens does not eliminate the evil. The draining of swamps has been very successfully practiced in New Jersey, and is applicable to other regions where large, swampy tracts occur. The use of oil, which spreads as a film over the water, forms a sufficient control, but requires continued attention and expense, and can scarcely be applied to most ornamental ponds or reservoirs or to pools from which animals drink.

There is thus need for other methods, and of these the spread of the natural enemies of the mosquitoes is by far the most important. These natural enemies are numerous, and the most valuable of them all for the purpose are fishes, which destroy the young stages of the mosquitoes as well as the adults when they alight on the surface of the water.

Among the fishes extensively used in mosquito control, the little killifishes or topminnows may be mentioned, but there are others which can be strongly recommended. This short report is written to call further attention to the value of the stickleback (*Gasterosteus*) as a mosquito destroyer in California, particularly in the coastal regions.

FACTORS RENDERING THE STICKLEBACK AN EFFICIENT MOSQUITO DESTROYER.

1. *The stickleback uses mosquitoes as food.* This point is to be proved first of all. The evidence is convincing. The stickleback has been seen snapping up adult mosquitoes thrown into the water. Mosquitoes are unable to breed in waters inhabited by sticklebacks. This conclusion, previously arrived at in regard to the stickleback and the salt-marsh mosquito of San Francisco Bay, has been rigidly tested out in many of the streams from San Francisco south to the Mexican border. Only a few examples from the observations can be made here.

In San Francisquito Creek, near Palo Alto, pools were repeatedly found near one another and apparently similar except in this respect: in the one pool sticklebacks were plentiful, but no mosquito wrigglers could be detected, while in the other pool sticklebacks were absent, while mosquitoes were breeding in abundance.

The swamps, pools and streams of the coast region of San Luis Obispo and Santa Barbara counties appear as ideal breeding waters for mosquitoes, yet the people there enjoy unusual freedom from these pests and dangers. A study of the region makes it almost certain that these people have the stickleback to thank for the service thus rendered. But, even in these regions mosquitoes breed in abundance in the mountain canyons into which the sticklebacks can not penetrate because of the steep descent of the bouldery stream beds. The mosquitoes are forced back, however, into the mountains where there are fewer people for them to torment.

In Mission Valley in San Diego sticklebacks are, for some unknown reason, entirely absent, but mosquitoes and gnats are very troublesome during the summer months. From the valley the mosquitoes are blown up the canyons to the city on the mesa above. During the summer the surface waters of the San Diego River, which flows through Mission Valley, are reduced to a series of pools. In these pools three introduced fishes, the golden bream (*Notemigonus crysoleucas*), the bullhead (*Amciurus nebulosus*), and the green sunfish (*Lepomis cyanellus*) are generally abundant. It seems that the stickleback is more efficient in the control of mosquitoes than are these three other fishes together.

During an entire summer's study of this problem, I never noted a considerable number of either mosquito wrigglers or sticklebacks in the same pool together. Wherever the stickleback can penetrate, and they go as far as they can, the mosquitoes are effectively destroyed.

2. *Abundance of other food will not deter the stickleback from feeding on the mosquito wrigglers.* This conclusion is evident from field observations, and is confirmed by the size and structure of the fish: its mouth, small even for such tiny fishes, will not permit it to feed on large insect larvæ such as those of dragon flies, which, by the way, upon emerging as the adult insect, feed upon the mosquitoes in the air.

3. *The stickleback feeds at all levels of the water, from bottom to surface.* Because of this fact, mosquito wrigglers of different habits are all picked up. Statements published by Seal, and by Lutz and Chambers for the stickleback of the East Coast, make it appear a bottom feeder. At least, such a conclusion does not apply to the stickleback of

California. I have thrown mosquitoes into a pool of the Los Angeles River, and scarcely would one of them drop below the surface before one of these little fishes would dart from some hidden corner and devour it.

4. *The habits of the stickleback render it destructive to mosquitoes.* This little fish hangs at any level of the water, tail bent to one side or the other, passively waiting for a stimulus to move. The wriggler is spied, and the stickleback snaps it up with pike-like speed and voracity.

5. *The stickleback itself is largely immune to the attacks of larger fishes.* This is a fact of much importance, giving the little spiny and armored stickleback a distinct advantage in many waters over other mosquito-eating fishes, as the topminnows. Sticklebacks live abundantly with rainbow trout, as in the Ventura River; and with black bass, as in the San Luis Creek. In ponds and reservoirs the waters could thus be stocked with both game fishes and sticklebacks, whereas the topminnows would, under such circumstances, soon be devoured.

6. *The stickleback is a widely distributed fish.* This little fish (*Gasterosteus aculeatus*), of several varieties, is found along the shores of all northern regions in the brackish waters of the bays and estuaries, and in the coastal streams. The stickleback in the streams of California extend their ranges from the estuaries as far up into the mountain canyons as they can penetrate. At high water they spread out and are trapped in many little pools from which mosquitoes are thus eliminated.

7. *The stickleback lives and breeds in small pools.* These pools include not only those along stream sides, but also the little shallow ponds and reservoirs about houses, which if not stocked with fishes, become breeding grounds for mosquitoes. For this purpose the stickleback is eminently fitted by its size, structure and habits. After planting once it requires no further care. Observations in California have led to these conclusions.

8. *The rise in temperature during the summer months seems not to kill the sticklebacks.* Where other fishes might be killed off in summer in shallow ponds and reservoirs, the sticklebacks seem to live on. These little fishes have even been found in the hot springs of Tia Juana, near the Mexican boundary.

9. *The abundance of sticklebacks in the streams of California provides an ample supply of these fishes for the stocking of artificial and natural pools, ponds and reservoirs.* A fine meshed minnow seine, or one made of from four to six yards of cheap cloth, can be used to obtain these fishes in the waters in which they live.

10. *The stickleback is a hardy little fish and will stand transportation from its native streams to artificial ponds, in open buckets or in cans, such as those used to transport fish fry for planting in streams distant from the hatcheries.*

PRACTICAL USE OF THE STICKLEBACK IN THE CONTROL OF MOSQUITOES.

No artificial cistern, pool, pond or reservoir should be left unstocked with fishes, and for this purpose the stickleback is probably the most practical fish in California, for the reasons which have already been outlined. By its use the breeding of mosquitoes about houses would

be prevented, and a troublesome nuisance and a real source of danger would be largely eliminated, for the mosquitoes which attack us have mostly been bred close by.

There would remain, however, many isolated pools in the salt marshes, along the sides of the lower courses of the streams, and in their upper canyons. These pools are usually without fishes, and in some of them dangerous mosquitoes breed in abundance. The stocking of these pools with sticklebacks would doubtless, in many cases at least, prove both possible and advisable. This might be done independently by those people interested in their own welfare, or perhaps better by some public official. It is quite probable that in the swampy lands and in the rice fields along the Sacramento River, the little topminnows would prove more efficient enemies of the malaria mosquitoes than the sticklebacks. The California Fish and Game Commission is working with that idea in view.

The control of mosquitoes is quite possible, in part by the use of the stickleback, as advocated in this article, and in part by other methods, such as the draining of swamps, etc. It is to be hoped that the proper authorities in California will increase their energy in this field, for the effective control of mosquitoes within its borders would make California an even safer and more pleasant place in which to live than it is now.

EARLY STAGES OF THE SPINY LOBSTER TAKEN BY THE BOAT "ALBACORE."*

By WALDO L. SCHMITT, United States National Museum.

The investigations of the Fish and Game Commission boat, the "Albacore," have recently yielded some valuable returns, during her scientific investigations of the commercial fishes and fisheries of southern California, in the shape of hitherto unknown larval stages of the California spiny lobster (*Panulirus interruptus*).

Under the auspices of the United States Bureau of Fisheries and through the courtesy of the Scripps Institution the writer recently spent some months in California primarily for the purpose of making a study of the Scripps Institution's extensive series of plankton samples in the hopes of shedding some light on the life history of the spiny lobster. Though in considerable number, only the earlier larval stages were represented in their collections.†

*Mr. Waldo L. Schmitt of the United States National Museum, has made a special study of marine crustacea, and the opportunity to provide him with material for the study of the early stages of the spiny lobster was a very welcome one to the Fish and Game Commission. His visit to this coast came at a time when the scientific work of the "Albacore" was but fairly under way, and the fact that it was able to provide him with material which seems to be of very considerable value should be of happy portent for the future. The superintendence of the hauls and of the handling of the nets was very competently done by Mr. Elmer Higgins, attached to the "Albacore" as a scientific assistant during her work on larval fish.

It will be well to call attention to the significance of the wide distribution of the larval lobsters. These flat, transparent organisms are found floating freely in the water, and are distributed by the currents. Although we do not know, of course, what proportion of the larvæ are carried along the coast by the currents, nor what numbers of them finally succeed in obtaining a suitable footing on the completion of their development, yet it should be fairly clear that there is an interdependence between widely separated regions inhabited by the spiny lobster.—*Will F. Thompson.*

†Subsequent to the taking of the large phyllosomes referred to below, one of like size was found in the Scripps Institution collections. It is interesting to note in this connection that in one of their large aquarium tanks they succeeded in hatching out the first phyllosome stage this past summer from the eggs carried by a single berried female.

But on August 29, 1918, while the writer was aboard the "Albacore," four phyllosomes of large size, the largest ever taken off California, were secured with the vessel's small otter-trawl. These specimens average about an inch in length, of body proper, and were obtained about 16 miles west of the Coronados Islands in 75 fathoms of water. One of these specimens is shown in the accompanying figure (fig. 14).

Including the above-mentioned specimens, the "Albacore" had taken up to the time of the writer's return from California, some fourteen lots of large and intermediate sized phyllosomes, and another rare stage

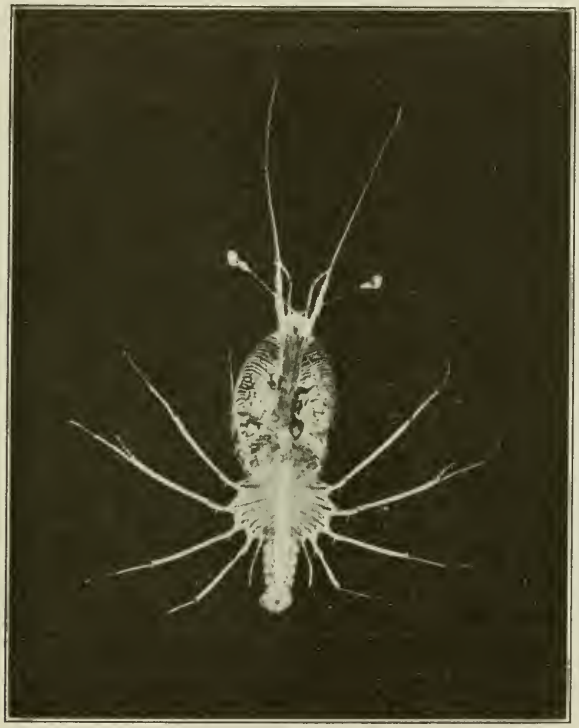

Fig. 14. Large phyllosome, an heretofore undiscovered larval form of the spiny lobster.

known as the puerulus. Some of these lots contained numerous individuals. The puerulus is the stage intermediate between the pyhllosome, the form in which the "lobster" is hatched from the egg, and the definitive form of the adult. These collections were well distributed through the southern California waters ranging as far as 150 miles off shore and to a maximum depth of 75 fathoms. This is a rather surprising range for such a well known littoral form.

So far as a preliminary examination of the material taken by the "Albacore" together with that obtained from the Scripps Institution goes, it appears that the early life history of the California spiny lobster is in a fair way of solution. A full report of the results of the summer's work is in preparation.

THE COYOTE AS A DEER KILLER.

By E. V. JOTTER.

Although we have long known the coyote as a predatory animal it has only been recently that we have obtained evidence of its destructiveness to big game. Heretofore known as a destroyer of quail, grouse and domestic stock such as pigs, sheep and poultry, the coyote must now be classified along with the mountain lion as a deer slayer.

In that many persons have been slow to believe that the coyote is a factor in our deer supply we have attempted to gather some evidence tending to prove that this animal is responsible for a considerable loss each year in Trinity County. This evidence is presented herewith.

Fig. 15. Male coyote taken in trap January 31, 1918, 14 miles south of Douglas, Trinity County, California, by C. O. Fisher. The stomach contained deer hair and meat. Photograph by C. O. Fisher.

Bert Higgins, who runs a trap line within the Trinity Game Refuge, reports finding along this one line during one month, the remains of fifteen deer killed by coyotes. Ranger Bucklew in April, 1916, saw a full grown doe, apparently in good condition, pulled down by one coyote.

Mr. Wm. Friend writes as follows concerning his experience with coyotes in the Game Refuge:

"In regard to the deer I found killed by coyotes in the Game Refuge, will say I commenced trapping between Little Creek and Bear Creek on February 1, 1916, and between that date and March 2, 1916, I found the remains of seventeen deer killed by coyotes.

They were all sizes from large bucks to fawns, but mostly small deer. The snow was about two feet deep and the deer had collected near the river and in gulches. After the snow settled the coyotes could run on top, but the deer broke through, so it was an easy matter for the coyote to catch them. In one gulch I came down I found eight deer that had been killed at different times—one of them had been killed

recently and none of them were over ten days. In many other sheltered places I found remains. In one instance about Feb. 1, T. H. Campbell and I were riding along the road near Philip Habor's place and saw where coyotes had just killed a spike buck and were enjoying a feast when we frightened them away. I also have a large pair of antlers I brought home from one of their victims. It is not only when the snow is on, but in the spring when the deer are weak, and poor, that they destroy a great many. I was coming home from my traps after the snow had gone and not half a mile from the Van Matre place I saw two coyotes that had a large buck run down and would have killed him if I had not happened along at that time. The deer was not able to get up the bank then."

Ranger Gray's report on the coyote is given in full:

"I would like to emphasize the necessity for a state-wide campaign against the coyote and other predatory animals, in which all the people of the state are to a certain extent interested and would help to bear the expenses of such work. It goes without question that a great public benefit would be derived in ridding the country of coyotes, either by increased bounties or by other means that would encourage more trapping. It seems that an increased bounty would be the most effective means of encouraging trapping, and in obtaining the desired result. I have conversed with a great many stockmen and local people during the season with a view to getting actual cases where the coyote has been observed killing game or stock. The result is, few people have been found that have actually seen the coyote killing either wild game or domestic stock; however, they know beyond any question of a doubt that he is responsible for certain large losses in both cases. There is one good reason among others why he is not more often detected in the actual work of killing, for his wandering and search for food is generally done in the hours of the night. In his wild nature he very carefully shuns man, usually selecting the most secluded places in which to carry out his destructive work. Earl Moore, T. Flournoy and other men who have been handling sheep for many years in these mountains advise me that they never saw a coyote actually kill a sheep. However, they state that they have seen them driving and worrying the sheep and upon following the trail they invariably found dead sheep scattered along the route. The greatest losses among this class of stock from the source mentioned is to small bunches separated on the range from the main bands, and left on the range during the night unprotected. W. H. Atkeson of Hoaglin advises me that he saw a coyote kill two small pigs near his ranch house. Many others disappeared in only a few days in the same locality.

Fred Becker, who resides on Pilot Creek, states that he saw four or five coyotes chasing a small deer. He did not know whether the deer was killed. Ben. B. Iliff of this place tells me that during the past winter a blood trail was noted crossing the road near his ranch house. The tracks of a deer were impressed in the snow together with small tracks that resembled those of small dogs. The trail was followed and Mr. Iliff asserts that in a short distance he found the carcass of a large deer and upon his approach two coyotes scampered away. C. W. Vann of this place cites an instance where he saw a coyote catch and kill a quail. Mr. Vann states that while hunting he approached a clump of low brush (poison oak) and flushed a bunch of quail. The quail in leaving the brush were quite close to the ground and he very clearly saw a coyote jump and take one of the birds as it passed very near him. I have found only a few other cases similar to these already mentioned."

Mr. W. T. Shock of Hayfork writes this letter:

"In reading over the weekly Trinity Journal I noticed the letter from W. O. Friend in regard to coyotes and as the Forest requests any good evidence against coyotes I submit the following: As I have trapped and hunted the coyote all my life, I will write a little of my experience. I find that the coyote is very destructive to many kinds of game of this county, not only deer, but all kinds of birds, such as grouse and quail, the nests of which it robs. A coyote can catch plenty of deer when there is no snow, but it destroys more when the snow is deep. Many deer that are found along the rivers are killed in this way. When the heavy snow comes, the deer gather along the rivers and low ground, as the snow is less there. When coyotes get hungry they take after a deer, and if they catch it before it gets to the river they kill it, but if the deer makes into the water, the coyote goes after another one. The coyote will not go into the water, but the deer that run into the water are

so hot and weak that they freeze to death before venturing out again. I have seen coyotes after deer, and running the coyotes away, I have tried to make the deer get out of the water and could not until I helped them out almost dead, and some have died while I was taking them out of the water. I trapped on the Hayfork Creek above the Game Refuge and near Mr. Dockery's place on Carr Creek last winter and a number of deer were gathered at Mr. Dockery's lower barn eating hay with his cattle. Between the first day of January and the twenty-seventh of February I found the remains of twenty deer, either killed by coyotes or run into the creek and killed, and I caught eleven coyotes."

Mr. Edward Shock, who lives within the Hayfork township and within a few miles of the town of Hayfork, upon his own ranch property, called at our office and made some statements concerning the damage done by the coyote, for which he personally vouches. He states that last summer, he does not remember the exact date, while he was working in his garden he heard a noise on the side hill adjoining the garden plot, and upon glancing up, saw a fawn coming down the hill and it ran into his wire fence three or four times before it managed to get through. Closely pursuing the fawn were two coyotes. Shortly after they got in sight they saw Mr. Shock, stopped, then turned and went back into the bushes. The fawn came into the field and quite close to Mr. Shock, then saw him, became frightened, turned and went back through the fence and up the hill in about the same direction the coyotes had taken. The coyotes no doubt later caught the fawn, since they would merely hide away in the bushes for a little while when interrupted in a pursuit of this kind, then take the track and follow on.

Another instance of Mr. Shock's observation was during this fall while setting a coyote trap. He set his rifle down a few feet from him and in finding a place to drive the stakes to hold the trap he had moved a few feet away from the rifle. While busily engaged he heard a noise and looking around saw a young deer without horns, presumably a doe, come running along closely followed by two coyotes, one of which caught the deer while yet in sight of him. Mr. Shock quickly went for his rifle, but when he got it the coyotes had taken alarm and had left the deer. Its tongue was hanging out and it seemed to be just about run down, but it of course went on out of sight. Mr. Shock is firm in his belief, based on his experience, that in such instances the coyotes were merely interrupted and would take the trail again and no doubt catch the deer.

He trapped nine coyotes within two weeks around his place and states that in opening up some of them to see what the contents of the stomachs were he found that they were largely composed of venison, there being evidence in meat, bones and hair. He also states that the coyotes he has caught were all very fat. Mr. Shock says that the reason for his trapping activity was on account of the coyotes catching the chickens. He has found it impossible to raise pigs unless they are well penned. Mr. Shock is a far better trapper than the average settler and has some methods of trapping that seem to get better results than the ordinary trapper. He says, however, that the coyote is a very difficult animal to trap and that he has found that he gets him more through his curiosity than any actual desire for food. Mr. Shock's experiences concerning the coyote are not at all unusual and could be duplicated by a great many of the settlers throughout the Trinity Forest.

These are specific, authenticated facts, which could be repeated by every man who has his eyes open. It really is not surprising that the attitude of mind expressed by the following exists. "Why shouldn't I have a deer," the settler says, "which will be eaten anyway by the coyotes; especially when I have killed one or more coyotes myself." Or, as the trapper would say, "Why can't I get a deer, or three or four, during a year? Even if I kill only one panther or trap only six coyotes, I have done more to protect and to increase the deer than any other person or organization has done."

Two important factors in the reduction of a game species are predatory animals and the hunter. We attempt to compensate for loss by the second factor by closing the season for a period of years to allow recuperation. Why could not similar results be obtained by reducing the toll taken by predatory animals? Although it is true that a certain balance is established between a species of game and its enemies when left to nature alone, it has been frequently demonstrated that man can alter such a balance very much to the advantage of the species that has been preyed upon.

Residents of Trinity County are agreed that by far the most pressing need in efficient game protection lies in the control of predatory animals. The liberal bounty on the mountain lion has eliminated this animal as a serious menace, but the coyote still remains abundant enough to be an important factor in conservation. An increase in deer, quail and grouse can best be effected by a vigorous campaign against the coyote and other predatory animals preying upon them.

CALIFORNIA FISH AND GAME

A publication devoted to the conservation of wild life and published quarterly by the California State Fish and Game Commission.

Sent free to citizens of the State of California. Offered in exchange for ornithological, mammalogical and similar periodicals.

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All material for publication should be sent to H. C. Bryant, Museum of Vertebrate Zoology, Berkeley, Cal.

February 3, 1919.

"Game laws are not passed with the idea of furnishing sport for a limited number of people, but to protect useful birds and animals for the benefit of the people as a whole."

THE 1916-1918 BIENNIAL.

Although due to war economy the 1916-18 biennial report of the Board of Fish and Game Commissioners is not so large or so attractively colored as the last report, it, nevertheless, contains some interesting facts regarding the activities, receipts, and disbursements of the commission during the past biennial period.

Outstanding features of the work of the past two years have been the erection of a splendid new fish hatchery in Inyo County, the building of a new patrol boat to be used in enforcing the laws in southern California waters and in the carrying on of fishery investigations, the enlargement of the activities of the commercial fishery department, including the administration of the kelp industry, an extensive educational and publicity campaign and the splendid results obtained in enforcing fish and game laws.

New laws enacted by the 1917 legislature have proved valuable. The Supreme Court decisions sustaining the state law prohibiting parcel post shipments of game has effectively stopped a much-used method of evading fish and game laws. The spiked-buck law continues to contribute much toward the conservation of deer, and at the same time has reduced the number of hunting accidents. Seventeen new game refuges created in 1917, comprising a total of 839,180 acres, have been well received by the public and are serving as safe breeding places for game.

The output of the fish hatcheries has been very gratifying, reaching a total of 25,697,420 in 1917 and 36,425,898 in 1916. A 16 per cent increase in the number of trout fry reared has been attained.

Scientific investigations of the fisheries have been undertaken and already valuable light on the habits and life history of the albacore have been obtained. The educational and publicity work of the commission is being well received by the public.

The principal recommendation for new legislation has reference to discretionary powers. Such legislation enabling the commission to close seasons, reduce bag limits, prohibit certain kinds of fishing apparatus, and in general take such immediate steps as will in their opinion afford prompt and effective relief and save from destruction by human hand that part of the wild life which has survived the adversity of nature, is pointed out as the greatest need.

Only a small edition of the biennial has been printed and it will be available only to those sufficiently interested to write to the commission for it.

FISH AND GAME COMMISSION NEEDS PLENARY POWERS.

The most important piece of fish and game legislation which the legislature will be called upon to enact this spring will pertain to the granting of plenary powers to the Fish and Game Commission. The need for this legislation has already been pointed out in these pages. The commission is not seeking more power, but simply a chance to make regulations which will allow better administration of the state's wild life resources. It should be clearly understood that regulations can not be enforced at will by the commission, but only after a hearing has been held and the regulations signed by the governor. The proper administration of the Migratory Bird Treaty Act is dependent upon regulations issued by the Department of Agriculture under authority granted it by Congress. To make the administration of state laws efficient, similar powers should be granted the commission managing the fish and game resources.

CALIFORNIA LAWS WILL BE MODIFIED TO AGREE WITH FEDERAL GAME LAWS.

California was one of the first states to make the game laws conform with those enacted by the federal government and the state has persistently upheld the Federal Migratory Bird Law. It is to be expected, therefore, that at the next legislature the few laws which do not conform with the new Migratory Bird Treaty Act will be modified. The state law still allows hunting one hour before sunrise and one hour after sunset. To agree with the federal law this section of the code will have to be modified so as to prohibit all hunting except between sunrise and sunset of each calendar day. The limit law on geese will have to be changed and the dove season made to begin on September 1. In the few cases where the California laws are more stringent than those of the federal government no change will be made.

VIOLATORS MAKE QUEER DEFENSE.

After some chronic violator of the game laws has been apprehended and a quantity of dried venison confiscated the usual plea is that the confiscated meat is bear meat or goat meat. The bones can be identified or the meat tested to prove that it is venison so that this plea as a rule is of little avail.

The same sort of defense has been offered by a violator recently arrested in Tulare County for having in possession the skin of a mountain sheep. This defendant at first maintained that the sheep was not a true wild sheep and later claimed that he killed the animal in self-defense. It will be an easy matter to prove at the trial that the skin held in possession was that of a wild mountain sheep and the violator will undoubtedly be heavily fined.

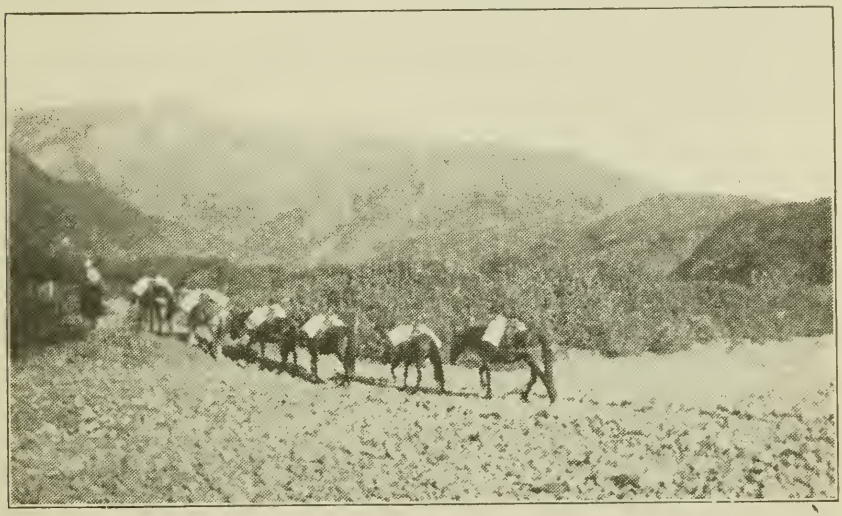

Fig. 16. Transporting fish to Salmon Creek in Monterey County. Although packed for ten miles on horses, the fish arrived in excellent condition.

MONTEREY STREAMS STOCKED.

Through the efforts of Senator E. S. Rigdon, Salmon Creek in southern Monterey County has been successfully stocked with trout. Although this stream is by nature a splendid trout stream, a large waterfall one mile from the mouth of the creek has made the upper reaches of the stream barren of fish life. It was with difficulty that 18,000 rainbow and steelhead trout recently planted in the stream were transported from the railroad. A fifty-mile haul with auto trucks from San Luis Obispo to Sanco Pojo Creek and then a ten-mile transport by horseback was necessary. The trip was

accomplished, however, without any appreciable loss in the fish. One variety of trout was placed in one branch of the creek and another in the other branch, about ten miles in all being stocked. From all reports the fish are doing well.

DUCK DISEASE AGAIN APPEARS.

During October, duck disease appeared in the Marysville Butte section of the Sacramento Valley. Hitherto, the disease has been restricted to the vicinity of alkaline lakes in the southern part of the San Joaquin Valley. Many hunters hunting near Colusa and Maxwell on the opening day of the season threw away their ducks after they had discovered many sick and dying birds about some of the ponds. The fact that an epidemic of anthrax had been prevalent in the same vicinity led many persons to believe that the ducks had contracted the same disease. This, however, seems very unlikely in that all birds under artificial conditions are largely immune to the disease, and it is not to be expected that birds of any kind would contract the disease under natural conditions. Sick birds secured showed every symptom of "duck sickness," a disease which is now well known through the investigations of the United States Biological Survey. Mr. Alexander Wetmore, assistant biologist, describes the symptoms as follows (The Duck Sickness in Utah. U. S. Dept. Agric. Bull., 672): 1. Paralysis of nerve centers controlling the muscular system (birds affected are able to support themselves in the air for short distances only or have the wings entirely helpless); 2, respiration is difficult and spasmodic; 3, pulse abnormal when bird is excited and in severe cases is weak and irregular; 4, nictitating membrane of eye reacts slowly (a test of the activity of this membrane is an important symptom); 5, eyes usually swollen and a discharge is noticeable; 6, alimentary tract practically empty, intestines shrunken, firm and much reddened; 7, excreta loose and watery, more or less greenish and voided at frequent intervals; 8, birds appear drowsy and lethargic though alert at the approach of danger.

By November 1 the epidemic had subsided and no more sick ducks were to be seen. The number of birds which fell victims to the disease is estimated at 5,000.

FEDERAL PERMITS.

The Migratory Bird Treaty Act provides for the issuance of scientific collectors' permits to all those interested in collecting either specimens or eggs, and also to breeders who desire to breed migratory or insectivorous birds. Permits to collect specimens are issued to properly accredited persons only and are required in addition to those issued under state laws. Applications for federal permits can be obtained when applying for a new state permit.

FISH COOKERY DEMONSTRATIONS.

For the purpose of stimulating the utilization of fish products, the United States Bureau of Fisheries has been conducting a series of demonstrations in fish cookery. Demonstrations have been held in San Francisco, Oakland, Berkeley, and Alameda, about 40 in all, with an average attendance of more than 100 women at each class. Mrs. Evelene Spencer and Mr. H. L. Kelly have been in charge. These demonstrations are made of practical value by securing the little-used and low-priced fishes, preparing and cooking them in front of the class, explaining every detail, and then serving each one present with a portion to taste. Even minute details of the proper way to skin a fish, remove the backbone, and slice it are shown. With the class watching, it is prepared for the oven, cooked and served.

Mrs. Spencer recommends the discarding of the frying pan, in favor of the hot oven method of cooking. Advantages are found in the elimination of unpleasant odors, the use of less than half the amount of fat usually required, and greater ease for both the cook and the one who has the serving of the fish. This is the method she uses in doing the work herself, and all who eat the cooked fish agree that it far excels in flavor the same kind of fish fried in the old-fashioned way.

The making of salads, both from freshly steamed fish, or from left-over fish is explained as is also the making of soufflés, creamed dishes and imitation

chops. Soups, which for flavor are the equal of any which can be made from meats or oysters, are made from the heads and trimmings ordinarily considered as being only fit for the garbage can.

Thirty-four varieties of fish, not including salmon and halibut, have been used in the demonstrations. Thus, it has been shown that a housewife can cook fish any day in the month, if she wishes, and not have the same kind twice. Of these, the most popular were small sole, skate, sablefish, mackerel, kingfish, yellowtail, shark, shad, rockcod and salmon milts. The price of these fish ranges from 5 to 15 cents per pound, and many hundreds of women were surprised to find a number of them they preferred to even salmon or halibut, which cost from 25 to 40 cents per pound.

Needless to say, these demonstrations have proved very popular with housewives, and have added materially in increasing the demand for flounder, shark, skate, squid, sablefish and other low-priced fishery products of the California markets.

INCREASED CONSUMPTION OF FISH NECESSARY.

Increasing the consumption of fish is far more urgent today than during war times. There is now no submarine menace; there are more ships and there are 200,000,000 people who must be fed if they are to be saved from starvation. Every ton of nonperishable goods possible must be sent to Europe. The use of fresh fish releases easily-shipped meat products for exportation.

There is absolutely no limit to the amount of fish which is now waiting in the ocean, and more are growing to supply our needs. The people of California have responded to every call made on them thus far, and we urge that they continue to show their patriotism and humanitarianism, by a still greater use of fresh fish.

NOTES ON THE NEW GAME REFUGES.

The following notes relative to the recently-formed game refuges have been culled from forest officers' reports for 1917. Apparently, the new refuges are filling the place for which they were set aside.

All refuges in California are created under the districting act and so must be designated as a "fish and game district." Each refuge is lettered with the number of the main game districts of the state in which the refuge is situated prefixed to it.

Fish and Game District 1-A, located in the Klamath National Forest, is admirably situated for the purpose for which it was withdrawn, being a natural breeding ground. It covers an area of about one township and varies in elevation from about 1,700 feet at the Klamath River to about 7,000 feet at the highest point, thus giving both winter and summer feeding ground. The general exposure of the entire area is southwestern, which makes it the very best from a climatic standpoint. There is also one of the largest salt licks known near the center of this refuge.

When the refuge was first created there was much opposition to it, but lately the sentiment has been more favorable.

Fish and Game Districts 1-B and 1-C in Modoc County are ideal breeding places for game and there is absolutely no doubt as to the wisdom of the move in having these areas set aside. The people, as a whole, are strongly in favor of them.

Fish and Game Districts 1-I and 1-J, in the Tahoe and El Dorado National Forests, have not been in existence long enough to note any change in game conditions. While the people most affected accept the establishment of the districts as a matter of law, some criticism is voiced relative to the location. Why was it not located "somewhere else" is the usual comment. This attitude will gradually disappear after a time if the districts receive proper administration.

The people all seem to think that the Chimney Meadow Refuge (Fish and Game District 1-L) will be of great value to the deer as it is the wintering grounds for all the deer in the Cannell Meadow District. Thos. Smith and John Johnson claim that they counted 75 deer in one band last spring in Long Valley, which is a part of this new refuge. There are a great number of hunters from Los Angeles and the Mojave Desert that hunt in this proposed refuge, and it will require a regular paid game warden in that vicinity to properly administer the refuge.

Fish and Game District 2-A covers a fine piece of deer country, having both summer and winter range. The establishment of the refuge was very well received by the public, and it is believed that very little hunting has been done within its boundaries. Considerable complaint was made by hunters and others, because the boundaries of the refuge were not posted. This should surely be done before the opening of the next hunting season.

The people are in favor of Fish and Game Districts 4-A and 4-B, comprising

600,000 acres within the Angeles National Forest. Deer are becoming more and more plentiful. If anyone is benefited by reason of an open season, it is the resort owners, and yet with the possible exception of one owner, a man who has been in court several times for alleged game violations, I have yet to find a resort owner who is not in favor of the continuance of the game refuges.

When Fish and Game District 14 was first formed the sentiment against it was very strong. This has changed and one finds very few hunters who do not favor it. The deer are increasing and one sees them in regions where there have been no deer for several years. With the increase of the deer a noticeable increase in mountain lion signs are also seen. Several lions have been killed, and many of the better class of sportsmen are talking of plans to rid the range of this pest. Our greatest trouble, however, is not the lion, but the unscrupulous hunter who sneaks over the boundary of the refuge.

A NEW GAME FARMING PROJECT.

A beautifully illustrated prospectus entitled Wisconsin Zoological Park, for the Propagation, Improvement, and Utilization of Wild Life has recently been issued by a newly-formed corporation with headquarters in Chicago. The intent of the organization is set forth as follows:

Food, it is said, will win this war. And it therefore becomes the duty of everyone to give careful consideration to all plans to increase our food supply.

The American farmers, responding to their country's call, are planting every available foot of their land, which means that we have about reached our maximum in food production unless we can devise some way of utilizing the undeveloped regions. Naturally, our thoughts turn to the nearby cut-over timber lands as a possible solution of this problem. We all understand the difficulties that have presented an almost insurmountable barrier to the development of these sections and the necessity, on account of the scarcity of labor, of finding some use for this land without having to clear away stumps, rocks and timber.

The Wisconsin Zoological Park was created chiefly for the purpose of dealing with this problem. It proposes that these lands be used just as they are, in the breeding and raising of wild life objects as a source of supply.

This is a comparatively new idea, and to be understood and appreciated must be carefully studied. The purpose of this booklet is to explain some of the most important features of this enterprise.

This company proposes to demonstrate in a practical manner how cut-over land can be quickly and profitably utilized in accordance with the ideas above set forth, and at the same time carry on extensive experiments towards the development, improvement and preservation of wild animals.

It is hoped the company will become self-sustaining, but if it does not, those responsible for it have not been actuated by selfish motives. They appreciate that pioneers in any great enterprise must take chances of loss, but are confident of their ability to eventually work out a plan which can be followed with profit by others.

To the uninitiated the plan is a very plausible one, and it will doubtless appeal to many. In view, however, of the success thus far attained in game farming, the outcome of the project as a commercial enterprise seems doubtful. If it will lead to the setting aside of large areas as breeding grounds for native animals, it will be very much worth while.

LOUISIANA ORIGINATES NEW DUCK.

The Department of Conservation of the state of Louisiana is attempting to secure a new duck for their marshes by breeding. The experiments are being carried out on the assumption that if a cross between the summer mallard or black duck and the winter visitant greenhead mallard could be established a race of nonmigratory ducks could be produced for the Louisiana marshes. The new type of mallard is in the third generation and a type has been selected which appears to have characteristics of both the mallard and the black duck. Whether the new duck will become a permanently resident bird capable of being introduced remains to be seen.

ALASKA FISHERY PRODUCTS.

The Fisheries Service Bulletin states that although final figures showing the value of the fishery products of Alaska in 1917 are not yet obtainable, the statistics are practically complete so that a reasonably accurate statement of production can now be made. Compilations indicate that the total value of such products was $51,405,260 in 1917. Of this amount 93 per cent, or $47,778,081, represents the value of the salmon products which consist of 5,947,286 cases of canned salmon, valued at $46,304,090, and 16,347,367 pounds of mild-cured, pickled, dry-salted, fresh and frozen salmon, valued at $1,473,991. The halibut fish-

eries rank second with an output of products valued at $1,120,226. In the order of production, the herring fisheries come next, with a yield of products valued at $767,729. The value of the cod products was $744,976. Whaling operations returned products worth $653,852. The production of miscellaneous fishery products including clams and other shellfish aggregated $340,396 in value.

This unprecedented yield of fishery products in Alaska at a time when the world is in need of food is called an achievement for which the country may justly feel gratified.

The fur products of Alaska are also of considerable importance and value, as evidenced by the fact that in the year from November 16, 1916, to November 15, 1917, shipments from that territory reached an aggregate value of $1,031,638, exclusive of fur-seal skins and fox skins shipped by the government from the Pribilof Islands. In the calendar year 1917 the government shipped from the Pribilof Islands fur-seal skins valued at $274,291 and fox skins valued at $35,680. —*Science*, June 7, 1918.

NOVA SCOTIA USES WAR METHODS TO CAPTURE VIOLATORS.

The fact that most of the illegal fishing in Nova Scotia has been carried on by gangs of men in the darkest hours of the night when it is impossible to discover the offenders without some means of artificial illumination has prompted authorities to furnish wardens with "Trench Light" pistols. These lights which have been very effective by the allied armies and navies are contained in metallic cartridges and are fired from a breach loading four-bore pistol which throws the magnesium stars to a distance of 400 or 500 feet. The lights burn for five or ten seconds and light up the whole neighborhood so that everything can be distinctly seen even on the darkest night. In addition to its efficacy in illuminating, it acts as a weapon of self-defense which poachers will learn to fear as much as the revolver. The "trench light" has been decided upon only after experiments with acetyline searchlights, electric searchlights, and magnesium Roman candles.

CALIFORNIA TRAPPERS AND THEIR CATCH.

For the open season 1917-18, nearly 4000 trappers' licenses were issued. As the trappers' license law provides for the killing of fur-bearers destroying poultry and domestic animals, no record can be obtained of those so killed and the reports of trappers of the take for the year do not give the total number of animals taken. However, the reports do give a basis for a computation as to the value of the annual take of furs. According to the reports of those holding trappers' licenses the take for last year was as follows:

Species	Number taken	Average price
Skunk	10,480	$1 74
Mink	804	2 95
Pine marten	127	5 90
Fisher	28	----------
Weasel	59	----------
Badger	82	----------
Raccoon	2,309	1 87
Ring-tailed cat	1,381	40
River otter	23	----------
Fox	2,268	2 16
Bear	55	----------
Coyote	1,941	3 00
Mountain lion	7	----------
Wild cat	1,488	1 73
House cat	111	----------
Opossum	18	----------
Muskrat	60	----------
Woodrat	20	----------
Mole	3	----------

The wolverine is apparently a very rare furbearer and not a single skin of this animal was reported. It is also interesting to note that such well-known furbearers as the marten and fisher are so reduced in numbers in this state that only a small number were taken in 1917-18. The average price indicated was obtained by averaging the amount received for at least 100 different pelts of a species.

FACTS OF CURRENT INTEREST.

A recent report from the United States Supreme Court does not concern the present regulations regarding migratory birds, but relates to the regulations in effect previous to the signing of the treaty with Canada. The present regulations are based on a treaty and will be in effect for fifteen years, unless abrogated by consent of both contracting parties. Because the present regulations are based on a treaty they can not be reviewed by any court.

On information furnished by deputies of the Fish and Game Commission three violators of the Federal Migratory Bird Treaty Act have been arrested and each is being held under a $250.00 bond.

Steelhead trout fishing in the Russian River will be excellent this year. The bar is open and there is plenty of water.

February 1 will mark the close of one of the best quail seasons in many years.

The elimination of market hunting by federal enactment has reduced to a minimum violations of the laws protecting waterfowl.

The game refuges created by the last legislature have now been posted and hunters will have no excuse for hunting within them.

Plans are being made to secure some moving pictures of the commercial fisheries of southern California to be used in educational work.

The State Game Farm at Hayward was discontinued on November 16, 1918.

Deputies of the Fish and Game Commission in the areas where there is waterfowl shooting have been appointed federal wardens. Twenty-one deputies now hold federal commissions.

Federal permits allowing a rice grower to herd ducks from his fields put a stop to agitation relative to depredations by ducks. No appreciable damage to rice when in the shock was reported.

The epidemic of duck disease in the vicinity of the Marysville Buttes was of short duration and less serious than similar epidemics which have occurred at Tulare Lake in past years.

HATCHERY NOTES.

W. H. SHEBLEY, Editor.

FISH DISTRIBUTION, 1918.

While the fish distribution operations for all of the hatcheries were completed by the forepart of October, complete reports have not, as yet, been filed. However, it is possible to give an approximation of the total distribution from the different stations for the season of 1918.

MT. WHITNEY HATCHERY.

The past season has been most favorable for operations at the Mount Whitney Hatchery, and the trout distributed were some of the finest fish ever reared at any of our hatcheries. Some of the eastern brook and Loch Leven trout distributed this year were from four to

Fig. 17. Wild geese at fish pond, Mount Shasta Hatchery, September 30, 1918. Photograph by J. L. Stinnett.

MT. SHASTA HATCHERY.

The approximate total number of fish distributed for the season was as follows:

13,500,000 quinnat salmon.
2,600,000 rainbow trout.
1,100,000 eastern brook trout.
1,600,000 Loch Leven trout.
2,000,000 steelhead trout.
230,000 black-spotted trout.

Two fish distribution cars were operated during most of the distributing season. The fish were all strong and healthy, and nearly all applicants reported that consignments were received and planted in the streams in good condition. Mount Shasta Hatchery is now being put in readiness for the coming season's trout operations and for the salmon work.

five inches in length, which is a very remarkable growth for one summer. Following is an approximation of the number of fish distributed:

1,000,000 rainbow trout.
83,000 eastern brook trout.
70,000 Loch Leven trout.
240,000 steelhead trout.
240,000 black-spotted trout.
400,000 golden trout.

The golden trout eggs were obtained from the Cottonwood Lakes Station, which was established for the purpose. Owing to the remoteness of this station from railroad lines and the rough, almost inaccessible country through which the eggs had to be carried by pack animal to the Mount Whitney Hatchery, the extent

of our operations was necessarily limited, but we feel that the results obtained have justified all the hard work and expense. Although several efforts have been made in past years to collect the eggs of the golden trout, this is the first attempt that has been successful. The success of the operations this season is due to the skill and resourcefulness of Mr. George McCloud, Jr., who was in personal charge of the golden trout egg collecting operations at Cottonwood Lakes and of the Mount Whitney Hatchery, at which station the eggs were hatched and the fry reared. The golden trout are very difficult to rear, but the results obtained in this delicate work far exceeded our expectations.

Plants of golden trout were made in the Santa Ana River, San Bernardino County, and in Mammoth Creek and Convict Lake, Mono County. A shipment of golden trout was planted in Lake Tahoe, and a consignment sent to Mount Shasta Hatchery to be liberated in the McCloud River at a later date. Practically all of the waters of southern California and the lower San Joaquin Valley counties were stocked with fish from the Mount Whitney Hatchery this season.

Fish Distribution Car No. 01 was detached from distribution operations at Mount Shasta Hatchery the forepart of September and sent to southern California to undertake the shipping of fish from the Mount Whitney Hatchery. The work was completed in a little over a month. After the completion of the season's fish-cultural operations the crew was assigned to make the improvements on the Mount Whitney Hatchery grounds, and this work is now progressing nicely.

MT. TALLAC HATCHERY.

The Mount Tallac Hatchery was operated as in past seasons, black-spotted trout eggs being taken from the fish ascending Taylor Creek to spawn. In addition to the 1,200,000 eggs of this species hatched at the station for distribution in the tributary streams of Lake Tahoe in the vicinity of Mount Tallac, shipments of eggs were made to Tahoe Hatchery, Mount Shasta Hatchery and the Feather River Experimental Station; 150,000 rainbow and 380,000 steelhead trout fry were also distributed in the tributary streams of Lake Tahoe from Mount Tallac Hatchery this season. The steelhead trout should thrive well in the waters of Lake Tahoe, and the addition of this valuable species of trout to the other varieties in the lake will be greatly appreciated by the anglers of the state who enjoy the fishing in this region.

TAHOE HATCHERY.

From Tahoe Hatchery were distributed 15,000 rainbow and 420,000 black-spotted trout fry in the streams and lakes in the Tahoe Basin and in the vicinity of Truckee.

FORT SEWARD HATCHERY.

The streams of Humboldt and Trinity counties were stocked with rainbow and steelhead trout fry to the number of 200,000 and 1,000,000 respectively from Fort Seward Hatchery this season. Mad River, tributaries of Humboldt Bay, and Eel River and tributaries, received most of the fish.

Quinnat salmon eggs received from egg collecting operations on Eel River near Bryan's Rest last fall were hatched at Fort Seward Hatchery, together with shipments of eggs of the same species from Mount Shasta Hatchery, and the resulting fry to the number of 1,000,000 were planted in Mad River, tributaries of Humboldt Bay and Eel River. As egg collecting operations near Bryan's Rest were not satisfactory, a new experimental station was established this fall on Bull Creek, a tributary of Eel River, near Dyerville. Owing to the fact that there was not enough rainfall to raise the river sufficiently to enable the spawning fish to ascend the stream, no Quinnat salmon eggs were taken early in the season, but later rains during the month of November improved conditions.

DOMINGO SPRINGS STATION.

The season's operations at Domingo Springs Hatchery were very successful. In addition to the rainbow trout eggs sent to other hatcheries, 317,000 were hatched and the fry planted in lakes and streams in Lassen and Placer counties. A shipment of 100,000 steelhead eggs was sent to Domingo Springs, and the resulting fry planted in lakes in that vicinity.

UKIAH HATCHERY.

The streams of Mendocino and Sonoma counties received their usual portions of steelhead trout fry from Ukiah Hatchery this season, 420,000 fish being planted in the two counties.

ALMANOR HATCHERY.

Egg collecting operations at Almanor Hatchery resulted in a take of less than 200,000 rainbow eggs. The resulting fry were distributed in Lake Almanor and near-by streams.

FEATHER RIVER HATCHERY.

Operations at the experimental station established near Blairsden on the Western Pacific Railroad were not successful, as the water supply from Grey Eagle Creek did not prove to be satisfactory for fish-cultural operations. Rainbow and black-spotted eggs were shipped to the station to be hatched and reared, but they died in great numbers both before and after hatching. The station has been dismantled, and the equipment will be used at one of the other stations.

BEAR LAKE HATCHERY.

Fish distribution operations were finished on September 5, and the station closed after completing the most successful season since the hatchery was established. At the egg collecting station on North Creek, 3,500,000 rainbow eggs were taken. After being "eyed," they were shipped to Mount Shasta, Mount Whitney, Tahoe, and Bear Lake Hatchery at Green Spot Springs; 300,000 were also hatched at the North Creek Station, and planted in Big Bear Lake. A total of 1,075,000 rainbow trout fry were distributed in streams of San Bernardino County, and in Big Bear Lake, from Bear Lake and North Creek stations. At the present time assistants are engaged in making repairs and improvements at the two stations. Negotiations are now under way for the purchase of a fine power boat for use in egg collecting operations, transferring materials and supplies, etc., which will greatly facilitate the work next spring.

BROOKDALE HATCHERY.

Steelhead trout fry to the number of 700,000 were distributed in the streams of Santa Cruz and Santa Clara counties from Brookdale Hatchery this season, in addition to shipments of steelhead eggs made to Mount Shasta and Mount Whitney hatcheries for distribution in other sections of the state.

WAWONA HATCHERY.

The completion of the new hatchery at Wawona enabled us to handle the fish to much better advantage this year. Streams in the vicinity of Wawona received 75,000 rainbow and 195,000 steelhead trout fry.

CLEAR CREEK HATCHERY.

A small hatchery has just been completed on Clear Creek, Lassen County, near Westwood. Eggs will be shipped to this station from Almanor and Domingo Springs hatcheries next season, and the fry hatched for distribution in the streams in the vicinity of Westwood.

KLAMATH RIVER STATION.

The new Klamath River Hatchery, which is being constructed by the California-Oregon Power Company, and which will be turned over to the California Fish and Game Commission when completed, in lieu of the construction of a fish ladder over the Copco Dam, is well under way. As it was not possible to complete this hatchery in time to trap this year's run of Quinnat salmon, a temporary station was established at Klamathon. Owing to the failure of the main run of salmon to reach the point at which the racks are located, on account of the long dry fall, the take is therefore much below normal.

COMMERCIAL FISHERY NOTES.

N. B. Scofield, Editor.

TIDE CONDITIONS INJURE FISHERIES.

The unusual conditions of water temperature and currents along the California coast during the past summer were largely responsible for a greatly reduced catch of albacore in southern California and evidently caused the appearance of new and strange fishes as elsewhere noted in this magazine. They also affected the catch of sardines and salmon and seriously handicapped the

growth of kelp. For nearly five months sardines were not found in sufficient numbers in southern California to keep the canneries busy.

Kelp. The kelp on the surface of the water ceased to grow and the serious shortage of this seaweed which occurred made it very difficult for the kelp potash companies to secure enough to supply their plants. It is feared that even the new shoots, which come up and take the place of the long stipes on the surface of the water after they have been cut, have been killed. The best growing time of the kelp has usually been in the winter months. Just how the stunted summer growth will affect the growth during this winter is as yet unknown.

It is now quite certain that the close of the war will have the effect of putting many of the California kelp potash companies out of business. Before the war the price of potash was about $65 per ton, but for the past year it has been between $250 and $350 per ton. If the price of potash decreases one-half, the majority of the companies will have to cease operations. Already the demand for potash to be used in the manufacture of munitions of war has ceased to exist. The immense plant of the Hercules Powder Company near San Diego has discontinued harvesting kelp and has issued notice to its one thousand employees that shortly their services will not be required. This company has done a great deal of investigation work in developing important by-products through the manufacture of which they expected to be able to continue operations even after the close of the war, but it has finally been decided that in view of the market prices that will have to be met shortly and the entire lack at present of a market for certain of the by-products, it will be best to reduce the operations of the plant to a very small scale and only two or three by-products will be produced there with a small force.

Salmon. The salmon catch at Monterey during the summer was only about half the usual amount. The fish almost entirely disappeared before the end of May. The catch for June, which is usually large, was a failure. But the fish which escaped the hooks of the fishermen in Monterey Bay later made their appearance in San Francisco Bay and the Sacramento River on their way to cast their spawn in the river's headwaters. Their appearance in the river was much later than usual and at the time when the fishermen and salmon packers were importuning the Fish and Game Commission and the Federal Food Administration to extend the season the salmon put in their appearance in great numbers. For a period of two weeks the salmon kept coming in such numbers that sufficient help could not be obtained to take care of the catch. The final result has been that the combined catch of Monterey Bay and the Sacramento River was the largest for several years. The amount of salmon taken up to the end of September in Monterey Bay, outside of the Golden Gate, San Francisco Bay and the Sacramento River was 11,040,075 pounds.

The catch of salmon by trolling at Fort Bragg was good; the total amount of the catch reaching a million and a quarter pounds. The run at Eel River was considered a failure, the amount taken being less than half the usual catch. The run on the Klamath River also shows a falling off.

THE SALMON INDUSTRY MENACED.

To dam the waters of the Sacramento at the narrow Iron Canyon above Red Bluff and thus make an immense impounding reservoir for flood control and irrigation purposes, has for years been a dream of those who would develop the resources of the upper Sacramento Valley and of those who have been interested in controlling the floods on the lower river. There have been frequent efforts to make this dream come true, but it is only recently that there have been hopes of its realization.

It is now proposed by assessing the land in the area to be benefited and by the aid of the state and the United States government to raise $20,000,000 for the construction of the dam and irrigation canals. The site of the dam is seven miles above Red Bluff. The proposed dam will be so high that salmon ascending the river to cast their spawn will not be able to pass even by means of the best "fish ladders" which have been devised. An impassable dam at the Iron Canyon will cut the salmon off from all the upper tributaries in which they naturally spawn, with the exception of Mill

Creek. If remedial measures can not be devised three-fourths of the present salmon run will be lost.

Remedies which suggest themselves are to attempt to establish runs in other streams, especially in tributaries of the San Joaquin and to establish a hatchery at the dam. Many difficulties present themselves in any plan to catch salmon at the dam, chief of which is unsuitable water temperature. Salmon of the spring run will not be mature enough to warrant holding at the dam for spawning purposes and if eggs are collected at the dam from the summer and fall run, the water available for the hatching will be too warm. Even if the eggs could be held in a hatchery at the dam until they are "eyed" at which stage they could be shipped to other hatcheries more favorably located on the river above, there would still be the problem of getting the resulting fry down over the dam in their seaward migration.

If such a dam is built, and it appears now it will be built, the salmon industry is sure to suffer an irreparable loss.

SPERM WHALE TAKEN OFF MONTEREY.

On November 21, Monterey fishermen found a dead sperm whale off Point Pinos near Monterey. They towed the carcass to Monterey where it was sold to one of the local fish concerns for $300. The length of the whale was 65 feet and it produced ten barrels of case oil. This species of whale is very scarce on this coast, and according to old residents of Monterey this is the first sperm whale that has been taken in that region for at least forty years.

LOCATING SARDINES BY AEROPLANE.

The serious shortage of sardines in southern California during the past summer has suggested the idea of locating the schools of sardines by means of aeroplanes. The great difficulty in catching sardines is in locating the schools of fish. On account of light on the surface of the water it is difficult to locate a school of sardines unless the boat runs into them. Fishing is usually carried on at night, at which time the phosphorescent glow caused by the swimming fish is more easily seen, but even at night this phosphorescent light can be seen only a short distance. It is a well-known fact that schools of fish can be more easily seen from an elevation where the observer is away from the glare of the reflected light at the surface of the water. From an aeroplane schools of fish are easily seen which are invisible to a person from the deck of a boat. At such times as fishermen are unable to locate schools of sardines, or of albacore for that matter, it would be practicable to employ an aeroplane for the purpose, which adds one more argument for those who would commercialize the aeroplane.

NEW WHALING STATION ON MONTEREY BAY.

The California Sea Products Company has almost completed a large, modern, fully equipped whaling station at Moss Landing on Monterey Bay, which will employ forty men when in operation. In addition to the whaling plant this company expects in time to operate a sardine cannery and during off seasons to use their boats to supply fish to the fresh fish trade.

There has been some objection to the establishment of a whaling station on Monterey Bay for fear that it would injure the sardine industry, under the belief that it is the whales that drive the sardines into the bay. This is an old belief which comes to us from the European coast where at one time it was believed whales drove the herring into the sheltered waters of the bays and fjords. Herring do not enter sheltered waters along the coast to escape whales, but for the purpose of spawning in the shallow waters where their eggs are attached to rocks and seaweed. There is no evidence that whales drive sardines into bays.

NEW FISH NET.

A new fish net has been devised for catching sardines and other small fish known as the purse-lompara net. This net is in use at Monterey and is in all respects a lompara net except that a purse line has been added to the bunt of the net which enables the operators to pull the lead line in more quickly after the net is partly in, thus impounding the fish in the bunt of the net. With this net it is easier to catch sardines in the day time without their sounding and getting under the net when it is operated in deep water. By using this semipurse arrangement a shallower net than otherwise can be used, which makes its operation quicker and more economical.

CONSERVATION IN OTHER STATES.

CONSERVATION LESSONS FROM MASSACHUSETTS.

The Massachusetts Fish and Game Commissioners are calling attention to the need of the conservation of fish by means of "little lessons." One of them follows:

"The advance of civilization always decreases the natural fish and game supply. Preach and practice conservation.

"Don't take fish that are full of spawn; leave them to deposit their eggs and the small to grow into mature fish.

"Don't take more than you need.

"Don't try for the largest number; try for the largest fish.

"Don't try to get the last one; leave some for others.

"Report violations to the Fish and Game Commissioners.

"Remember, this is your sport. No one is as interested in it as the hunters and fishermen, and it is up to you to make or ruin it."—*American Field*, May 2, 1918.

CATS BECOME GAME IN NEW YORK.

In New York a bill has been passed, permitting any person over twenty-one years of age who holds a hunting or trapping license to destroy humanely a cat at large found hunting or killing any protected bird, or with such a bird in its possession. The bill makes it the duty of the game protectors to kill all offending cats.

MINNESOTA GAME REFUGES.

In the State of Minnesota state parks and state forest reserve lands have automatically become refuges for game. The legislature of 1915 provided for a practical way of establishing game refuges on privately owned land. Already seventeen refuges have been established in this way, embracing 531,925 acres. The combined area of all of the Minnesota game refuges is 1,877,813 acres. This method of protecting and restoring game has met with instant and hearty approval by the people of the state and in every instance in which a refuge has been established, there has been a unanimity of sentiment among the people interested in it.—Bien. Rpt., Minn. Fish and Game Comm., 1916.

MINNESOTA DISTRIBUTES FISH.

Under the authority of the Public Safety Commission, the state of Minnesota has been catching and distributing fish. From October 15, 1917, to January 1, 1918, the production of state-caught fish amounted to 77,851 pounds. Great care is being exercised not to take fish that are desirable for angling from localities where people can and will use lakes for that purpose. In such localities fishing is confined to rough fish only. As a contribution to the food supply the state fishing has demonstrated its importance and has proved to be popular and successful. Distribution has been made through game wardens, representatives of the Safety Commission, meat dealers and other individuals.

NEW JERSEY RESTOCKED WITH RABBITS.

The game farm of the New Jersey State Fish and Game Commission has two thousand rabbits which will be distributed throughout the state. Rabbits will be placed in districts where they have been hunted out.

LIFE HISTORY NOTES.

TREE-DUCKS SUCCESSFULLY BRED IN SANTA CLARA COUNTY.

A pair of fulvous tree-ducks (*Dendrocygna bicolor*) were secured from the State Game Farm in the fall of 1916 and placed on my pond at Cupertino. In June, 1917, I had a suspicion that they were laying, as I found several eggs which I could not classify in different parts of the enclosure. I have learned from experience that one can not disturb ducks during the laying and breeding season, and in the past I know that I have broken up several "settings" because of my curiosity. In June of this year I noted from casual observance that only

one of my fulvous ducks was on the pond, and fearing that the other had been lost or had died, I started an investigation and after some days found the nest very close to the water's edge on a ledge of rock in a rustic rockery constructed in the pond for ornamental purposes. This ledge was concealed by overhanging vines and it was very difficult for me to see it. Not wishing to disturb the birds, I did not make a close investigation, but as near as I could tell, there were five or more eggs in the nest. (This last is somewhat of a guess on my part.) As the birds seemed to be sitting, I left the nest severely alone, and some time around the 20th of June (I can not give the exact date) I was rewarded in seeing the mother duck bring out four young ones into the pond. These little birds did not appear to me to be much larger than young quail and I used my very best efforts in an attempt to segregate them, but without avail. My present pond is not constructed properly for breeding purposes, having been erected in the first instance purely for ornamental purposes, and the birds have not access to and from the water at all points, with the result that these little ducks became chilled and drowned, or were molested by the other ducks, all dying within four or five days. —J. V. DELAVEAGA.

RARE FISH FROM MONTEREY BAY.

The true halibut (*Hippoglossus hippoglossus*) was occasionally taken this last summer (1918) in Monterey Bay. It has not been reported before south of San Francisco.

A specimen of a fish sometimes called the "blacksmith" (*Chromis punctipinnis*) was brought to Hopkins' Marine Station at Pacific Grove by Japanese fishermen this summer. This fish has hitherto been unknown north of the Santa Barbara Channel.—E. C. STARKS.

MARLIN-SPIKE FISH USED AS FOOD.

The marlin-spike fish (*Tetrapterus nutsukurii*) now being caught by anglers near Santa Catalina Island is finding a good market in Los Angeles at a retail price of 25 cents per pound. It is said to be undistinguishable in taste from the swordfish. The writer recently enjoyed eating some of it, and found it one of the most delicious fishes he had ever tasted. Fresh tuna was served at the same time for comparison. It was much coarser fleshed and much less delicately flavored than the marlin-spike fish.—E. C. STARKS.

BREEDING OF THE FULVOUS TREE-DUCK IN SANTA CLARA COUNTY.

Early in the month of November, 1917, a fulvous tree-duck (*Dendrocygna bicolor*) was brought to me for identification by Miss Ethel Emerson. It had been caught when but a downy bird in the salt marsh near Mountain View, Santa Clara County, and was now nearly grown. Several others taken at the same time had died, one by one in captivity, but the survivor, when placed in a large cage with a pair of bantams, soon became very active and contented. Later its plaintive whistle might be frequently heard during the night, and at times it seemed to show irritation at close confinement. It remained wild and was easily frightened at the approach of people or other animals, as dogs and cats. When opportunity offered it made its escape after having spent somewhat over a year in captivity.

The most interesting point in all this is that it appears to furnish the first account of the breeding of the species in the marshes of San Francisco Bay, and I believe that the bird has not been recorded before in Santa Clara County. —J. O. SNYDER.

BANDED PINTAIL TAKEN IN ALAMEDA COUNTY.

On November 13, 1918, I shot at Alvarado, California, a pintail duck (*Dafila acuta*) bearing a metal band stamped "U. S. Biological Survey, No. 4009." Upon returning this band to Washington the following information was obtained:

The duck was captured while sick with alkali poisoning at Utah Lake, cured and banded October 10, 1916, after which it was exhibited with others at the Utah State Fair, and released. Its capture is good evidence of the permanence of the cure, and is of interest because of the fact that over two years intervened between capture and the date of banding.—EARLE DOWNING.

REPORTS.

CALIFORNIA FISHERY PRODUCTS—JULY, AUGUST, SEPTEMBER, 1918.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Alameda, Contra Costa	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego	Total	Mexico
Albacore										918	6,183,413		816,728	7,001,059	
Anchovy	100		3,800				46,129		114,450		21,599		600	186,678	310
Barracuda							7,146	43,987	144	21,307	760,329		573,677	1,406,590	116,692
Bonito								33,361	3,930	10,243	788,023		670,169	1,505,726	2,615
Bocaccio		1,603	1,936				1,424	354	286,556					291,873	
Bluefish									31,261					31,261	
Chilipepper							907		972					1,879	
Carp				1,187	12,773	8,588	347							22,895	
Catfish		260		644	1,460	5,422								7,786	
Croakers											20,754		893	21,617	
Coalfish							85,186		37					85,223	
Cultus cod	89	11,852	6,116				224,653	42,437	20,225		1,613			307,395	
Dolphin											720			720	
Dogfish			74,920				22,570		1,985		497		6,127	106,099	2,615
Flounder	705					58	381,278	25,125	740		32			407,938	
Halibut	19,750	30,172	1,094				1,758	1,721	11,795	57,823	88,045		20,077	232,235	1,438,057
Hake							54,122	8,000	220	64			457	62,863	
Herring	174									175				349	
Kingfish							21,973	10,508	54,097	400	28,771	160	5,095	124,004	
Mackerel								620	911,577	4,280	789,377		29,650	1,735,504	41,191
Mullet															
Marlin											2,014			2,014	
Pike						274								274	
Pompano							562	333	10		1,105		100	2,110	
Perch	10,646		513				12,884	794	360	810	4,133		390	30,550	
Rock bass										3,633	171,958		98,073	273,631	3,090
Rockfish	20,059	454	342				408,698	169,887	316,584	12,761	138,361		175,558	1,242,704	4,090
Sole	25						1,349,380	651,809	71,220	23,680	2,219			2,098,333	
Salmon	511,711	676,287	136,842	1,949,735	462,984	2,806,554	1,835,939	77,618	171,155					8,128,855	
Smelt	2,054		13,984			25	56,282	11,078	107,930	7,283	19,061	1,335	7,215	226,277	70
Sea bass (white)			34				28,309	102,062	47,303	59,384	630,600	395	21,912	890,002	146,903
Sea bass (black)										2,427	33,389		31,856	67,672	2,915
Sand dab							366,694	30,852	5,762		6,802			410,020	

Suckers					765									765	
Striped bass			1,857	11,029	2,324	53,481	53,167		94					121,952	
Roe shad					43	123								166	
Shad				2,053	678	4,544	93							7,368	
Buck shad					515	5,934								6,449	
Skipjack											2,134,341		2,719	2,137,060	
Sturgeon															
Sardine	741						283,210	107,715	27,761,816	42	485,841		2,432,666	31,072,031	
Skate							11,458	390	3,210		1,237			16,295	
Sword fish											16,862			16,862	
Sculpin											3,479			3,479	
Surf fish											3,945			3,945	
Sea trout											537		276	813	
Sheepshead											526		1,376	1,902	
Tom cod							638	55			11,197			11,890	
Trout (farm)							286							286	
Trout (steelhead)	7,279													7,279	
Turbot											12			12	
Tuna								315	1,012	1,009	4,505,777		143,702	4,651,500	
Whitebait							21,068							21,068	
White fish											2,179			2,179	
Yellowtail							21,520	21,349	13,116	15,506	2,556,327		3,593,169	6,220,987	17,219
Miscellaneous	2,000				72		29,544	750		1,554	82,445		12,952	129,317	126,290
Totals	575,743	720,628	241,438	1,964,648	481,614	2,885,033	4,860,135	1,341,120	29,037,594	223,299	19,497,520	1,890	8,645,437	71,376,069	1,902,087
Crustaceans—															
Crab (doz.)	62		12				1,682		1					1,757	
Spiny lobster															
Shrimp							249,562							249,562	
Ecrevisse															
Mollusks—															
Squid							120		23,729					23,849	
Cuttlefish							2,385		294					2,679	
Clam pismo								332		206,686				207,018	
Clam cockle			6,669											6,669	
Clam softshell	1,085	3,604	38,185			51,720								94,594	
Clam mixed			3,767				35		340					4,142	
*Oyster (shell) No.			425,395				1,518,335							1,943,730	
†Oyster, No.			272,021											272,021	
Abalones										95,345				95,345	
Mussels						793	1,142		123,449					125,384	

*Eastern. †Native.

VIOLATIONS OF FISH AND GAME LAWS.

September 1, 1918, to December 1, 1918.

Offense	Number of arrests	Fines imposed
Game.		
Hunting without license	38	$615 00
Deer—close season—killing or possession	3	75 00
Female deer, spike bucks, fawns—killing or possession	25	607 00
Running deer with dogs, close season	1	25 00
Failure to retain portion of deer head bearing horns	7	150 00
Illegal deer hides—possession	2	100 00
Bear—close season—killing	1	
Quail—close season—killing or possession	11	325 00
Doves—close season—killing or possession	2	
Duck—close season—killing or possession, excess bag limit	7	240 00
Shooting ducks from power boat in motion	1	25 00
Cottontail and brush rabbits—close season—killing or possession	2	50 00
Rail—close season—killing or possession	1	25 00
Wild pigeon—close season—killing or possession	1	25 00
Nongame birds—killing or possession	8	70 00
Shore birds—close season—killing or possession	3	75 00
Night shooting	13	225 00
Total game violations	126	$2,662 00
Fish.		
Angling without license	5	$125 00
Fishing for profit without license	7	80 00
Fishing with nets in restricted district	6	650 00
Striped bass—underweight	8	100 00
Salmon—Saturday and Sunday fishing close season—taking or possession, excess limit	7	600 00
Clams—undersize—excess limit	3	75 00
Abalones—undersize—shipping out of state	5	75 00
Spiny lobsters—close season—taking or possession	1	
Total fish violations	42	$1,705 00
Grand total fish and game violations	168	$4,367 00

SEIZURES—FISH, GAME AND ILLEGALLY USED FISHING APPARATUS.

September 1, 1918, to December 1, 1918.

Game.	
Deer meat	191 pounds
Hides	6
Ducks	125
Quail	19
Doves	1
Shore birds	1
Nongame birds	10
Rabbits	8
Miscellaneous game	10
Fish.	
Striped bass	841 pounds
Salmon	15,665 pounds
Trout	64 pounds
Crabs	157
Pismo clams	403
Abalones	124
Illegal nets	3
Searches.	
Illegal fish and game	1

STATEMENT OF EXPENDITURES—YEAR 1918.

Item of expense	May	June	July	August	September
General administration	$1,964 69	$1,875 49	$2,288 08	$1,844 69	$1,822 36
Research, publicity and educational (game)	422 19	309 83	333 24	259 40	363 99
Printing	262 48	45 00	769 95	511 84	
Fish exhibits		5 50			
Game exhibits		3 50			
Game farm	307 07	249 99	265 26	286 32	174 15
Mountain lion bounties	290 00	170 00	380 00	130 00	180 00
Lithographing hunting licenses	995 00				
Lithographing angling licenses					
Hunting license commissions	1,681 70	596 60	807 70	692 50	2,857 00
Angling license commissions	709 10	1,100 90	1,500 90	380 50	1,243 90
Market fishing license commissions	309 75	41 50	47 50	73 50	53 00
	$6,941 98	$4,398 31	$6,392 63	$4,178 75	$6,694 40
San Francisco district	$5,334 17	$5,788 45	$5,933 32	$6,398 24	$6,241 56
Sacramento district	3,542 81	3,704 20	4,036 63	3,905 00	4,003 60
Los Angeles district	2,537 28	2,462 45	2,304 00	2,128 17	2,491 26
Launch patrol	903 72	1,056 29	1,350 96	1,209 66	924 31
Prosecutions (fish and game)	104 75	318 49	93 50	73 75	87 85
Crawfish inspection	33 33				
Winter game feeding					
Accident and death claims	124 04	155 05	185 19	186 35	124 04
	$12,580 10	$13,484 93	$13,903 60	$13,901 17	$13,872 62
Hatchery administration	$1,030 65	$841 61	$1,081 33	$817 63	$1,040 83
Mount Shasta hatchery	1,544 41	2,024 76	3,812 12	6,679 96	3,090 54
Klamath station	6 60	5 60			803 99
Mount Whitney hatchery	2,168 48	1,974 57	1,774 34	2,512 81	2,204 94
Cottonwood Lakes station	58 48	675 60	196 10	45	
Tahoe hatchery	40 19	96 00	205 19	236 38	299 30
Tallac hatchery	886 16	405 06	469 74	206 01	67 85
Fort Seward hatchery	500 61	461 69	398 41	283 80	100 00
Eel River station				4 75	486 50
Ukiah hatchery	448 30	293 64	187 30	187 83	5 20
Snow Mountain station	155 60	100 00			
Brookdale hatchery	220 09	203 72	291 16	340 13	201 61

STATEMENT OF EXPENDITURES—Continued.

Item of expense	May	June	July	August	September
Scott Creek station	$76 00	$30 00	$167 00	$31 00	$30 00
Feather River hatchery	521 27	491 56	158 06	20 15	
Almanor hatchery	719 20	146 00	113 10	190 10	1 80
Domingo Springs hatchery	203 80	137 72	159 55	263 33	366 12
Clear Creek hatchery					27 93
Bear Lake hatchery	566 83	402 85	247 17	336 84	202 10
North Creek station					
Wawona hatchery	114 80	668 00	96 19	24 35	
Yosemite hatchery					
Fish distribution	373 68	963 15			
Fish transplantation			1 56	3 00	3 00
Screen, fishway and water pollution	473 36	566 19	1,022 78	544 51	109 83
Special field investigations			205 50	60 00	
	$10,108 51	$10,490 72	$10,589 90	$12,743 03	$9,344 81
Department of Commercial Fisheries	1,927 83	2,765 49	2,611 32	2,598 85	1,846 93
	$31,558 12	$31,139 45	$33,497 45	$33,421 80	$31,758 79
Department of Engineering—					
Launch "Albacore"		$3,709 42	$43 40		
Yosemite hatchery					$327 27

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CALIFORNIA FISH AND GAME

PUBLISHED QUARTERLY BY THE CALIFORNIA FISH AND GAME COMMISSION.

Volume 5 | SACRAMENTO, APRIL, 1919 | Number 2

CONTENTS.

		Page
THE CONSERVATION OF OUR FISHERIES	*W. F. Thompson*	49
THE BASSES AND BASS-LIKE FISHES	*E. C. Starks*	59
BEAR HUNTING WITH BOWS AND ARROWS	*Saxton Pope*	69
NOTES ON THE ARTIFICIAL PROPAGATION OF THE SPINY LOBSTER	*P. S. Barnhart*	70
IS THE HERRING GULL INSECTIVOROUS?	*A. C. Burrill*	71
IN MEMORIAM		75
EDITORIALS		76
FACTS OF CURRENT INTEREST		91
HATCHERY NOTES		92
COMMERCIAL FISHERY NOTES		93
Notes from the Long Beach Laboratory		94
CONSERVATION IN OTHER STATES		97
LIFE HISTORY NOTES		98
WILD LIFE IN RELATION TO AGRICULTURE		99
REPORTS—		
Fishery Products, October to December, 1918		100
Financial Report		102
Violations of Fish and Game Laws		103
Seizures		103
Number of Deer Killed in Season 1917		104

THE CONSERVATION OF OUR FISHERIES.

By WILL F. THOMPSON.

Fisheries are subject to depletion because of too intense exploitation, as has been proved in Europe and in our own country. It is the duty of the government, as the one element in the situation which is concerned with the perpetuation of the fisheries, to be able to recognize depletion, to know how to prevent it, and how best to promote the fisheries. It implies knowledge, perhaps not of what we are fond of terming pure science, but rather of applied, although the things to be applied are frankly still in large part to be discovered. Men engaged in educational work are almost invariably engrossed in the more abstract branches of science, and the commercial firms are thus far not interested in carrying on research save for the purpose of furthering the methods of utilization of the products. It is therefore left very largely to governmental authorities, on whom the responsibility of regulation rests, to pursue the subject.*

*See Fish Bulletin No. 2 for a more extensive discussion of this subject.

But what are the problems involved, and what must be done to recognize depletion? A fishery is, one may say, the reaping of a harvest which has been sowed by Nature, and is subject to great natural fluctuations and has unknown power of resistance in the face of continual reaping. The primitive man who went into the rice swamps and gathered his rice, without thought of how it was sowed, or how long it took to grow, was no worse than we are in our primitive attitude regarding our fisheries. The failure of his crop threatened his livelihood, yet he knew nothing regarding the causes of the failure, nor the fluctuations which might occur. What were these changes, were they due to his continual reaping, were they preventable, or might they be foretold? Just so we are asking today, what are these great fluctuations in our fisheries which may mean the prosperity or ruin of our industry, and how may they be prevented or foretold? If we can not cultivate, how may we preserve? They are elemental questions, indeed, to be asking on the threshold of an era of exploitation.

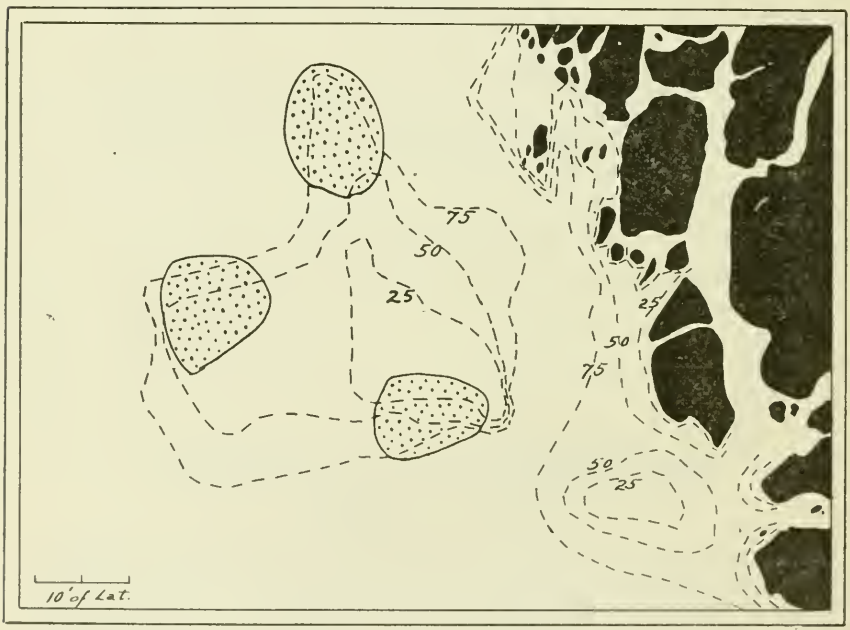


Fig. 18. Diagram of halibut bank in the North Pacific, illustrating the areas within which halibut are considered abundant enough to justify fishing. Depths shown by contour lines, fishing area by stippled spaces.

Men in general do not know what they are dealing with when they pursue a fishery for a certain species. Thus the conception that a species is as inexhaustible as the ocean is large is an erroneous one. The fish in the sea are distributed as unevenly throughout its parts as wild animals are on the land, with this qualification, that only the borders are inhabited by them to any extent. Thus a halibut fishery exists only on particular small areas called banks, or parts of banks, along the edge of the continental self in from thirty to a hundred and fifty fathoms where the conditions are suitable. In fact, just as mountain sheep are limited in their range, so are the halibut.

Then what strain will a species stand? Some think that the capacity of a species is limitless, because of the great number of eggs each individual produces. The halibut lays over a million and a quarter eggs every year of its breeding life, perhaps ten million in all, and the male produces the fertilizing sperm for the same; but this abundance of eggs merely foreshadows many dangers to the young, for from these ten million need come but two mature animals to maintain the species. If there were constantly more than necessary to maintain the numbers of the species, then the resultant increase must, however slight, eventually overcrowd the waters of the sea; and if there were ever so small a lack every year, then the species must vanish ultimately. Man's influence, however slight, like weighted dice in a game, might well, in the end make loss inevitable if it were not for the probability that many forces come into play to favor threatened species. Are those forces potent enough to counterbalance man's influence? Do we know that they are sufficient to avert final loss?

But has there ever been such a loss? Have not men fished for many centuries in the waters of Europe without over-fishing? Why should depletion occur now rather than long ago? But we know that this very thing has happened, and that there is good reason why it should have happened in our day. The great plaice fisheries in the North Sea have been proved over-fished, and in our own waters the halibut fisheries and those for the salmon of the Frazer are good examples of the same. And the reasons are not far to seek. They may be found in the relatively recent invention of the canning process, in the use of steam and gasoline for transportation, and in the use of ice and cold storage methods of preserving food. Salmon from the Frazer is known in Africa and Mexico nearly as well as we know it in America. Halibut taken by steamers and gasoline-driven boats in the Pacific is carried by express trains across the continent and across the Atlantic to England in a fresh condition. The cold-storage and the canning of fish have abolished boundaries and "off-seasons" in so far as many species are concerned. The net result of all this has been the recent vast enlargement of the market, and with that has come the equally vast enlargement of the fishing industry. This marvelous growth of our fisheries has not been appreciated, I am sure. Our sardine fishery, totaling in 1917 over 100,000,000 pounds, has arisen within the last four years. The great halibut fishery, which reached a maximum of 70,000,000 pounds a year, began in 1890, and is now on the decline. What will the future show to us in this regard? Well may we think seriously, and consider our words when we feel tempted to say that the resources of the sea are inexhaustible. The population to be fed may double its numbers in the next fifty years, and transportation may become twice as efficient. What will happen then?

And if the total catch continues to increase, as it has in the past, how may we recognize the commencement of depletion? First of all we must discount in our statistics the marvelous growth in apparatus and equipment, and discover whether a greater effort is required each year to gather the same amount of fish; in other words, ascertain whether decreased abundance necessitates greater effort. This means the abandonment of the old statistical ideal of portraying the magnitude of the industry, and substituting for it a more rational one of the observation of the real abundance of the fish.

But when a decrease is discovered, we must know whether it is a natural one or due to over-fishing, and we must know in time to take remedial measures, not when commercial extinction has solved our doubts. For there are great fluctuations in abundance (of very different extent in the various species) which are not the result of man's efforts but of natural causes, and a decrease in numbers of fish because of such is, of course, not permanent, any more than the causes are. To know the character of such a decrease implies a study of the biology of the species, which provides a distinctive mark for the results of over-fishing in many cases, if not in all. It also implies advancement of the science of the subject, a greater knowledge of the laws which govern the matter, for what is known at present is undoubtedly ill-defined.

The laws seem to be much the same as those which govern the human population, and the results of over-fishing what might be expected if "over-fishing" of human beings could be carried on in the same way. If the adults are removed by "over-fishing" the relative numbers of the adults decrease; and if the fishery continues to remove an equal number, the catch becomes a constantly greater proportion of the total left, thus heightening the rate of decrease. But if the young are not produced because of defective spawning conditions—which can not be blamed on the fishery—then the young are less numerous as compared to the undiminished numbers of adults until the latter have lived out their term of life. Decreased abundance of fish because of "over-fishing" of the older classes is therefore marked by decreased numbers of the older fish as compared to the young, while the reverse is true in the case of a natural decrease because of the failure of the young to appear. The inference is obvious, a record of the relative numbers of adult and young must be kept in connection with a record of the total abundance, and from it can be ascertained just where the loss in abundance occurred, the degree to which the fishery is responsible being to a great extent obvious therefrom.

If the failure of a spawning season could be ascertained early enough, it would provide a knowledge of the impending change. The value of such knowledge may well be illustrated by the history of the herring in Europe. It is well known that from the dawn of history great natural fluctuations in its abundance have occurred, according to which a great industry has been built up or destroyed, carrying with it the fate of whole towns. Recent studies by scientists in the Norwegian fisheries service seem to show that it is possible to forecast the magnitude of

TABLE 1.

Table* Showing Percentage of Each Age in the Catch of Norwegian Fat-herrings in Various Years, Illustrating the Appearance of an Unusually Abundant Class as Successive Ages in the Catch of Successive Years.

Catch	Age when taken							
	1 year, per cent.	2 years, per cent.	3 years, per cent.	4 years, per cent.	5 years, per cent.	6 years, per cent.	7 years, per cent.	Total, per cent.
During 1907	11.5	36.8	51.3	0.4				100.0
During 1908	0.1	51.4	10.3	37.8				99.9
During 1909	3.1	61.0	13.3	5.0	16.9	0.7	0.2	100.2
During 1910	0.2	50.7	42.0	0.9	1.7	4.5	0.1	100.1

*Note.—From Hjort and Lea, "Some Results of the International Herring Investigations," 1907-1911.

the yield according to the sizes of fish taken. A great drop in the abundance of the herring was apparently preceded by the failure of the youngest classes to appear in adequate numbers,—in other words a predominance of mature existed at the same time as a decrease in catch. The success of the commercial fishery for herring during a number of years, in fact, seems to have depended on the success of a single year's spawning, the product of which became larger and older every year but which was not supplemented by young produced by subsequent spawnings. The result was the lack of small fish until another successful spawning could occur. The consequence of the gradual natural disappearance of the old fish in such a case, without another class of small to take their place, may be easily imagined. If fluctuations of such magnitude as occurred in the herring fishery could be foretold, the doing so would be a truly great accomplishment for the good of humanity.

Yet such a service would not be comparable to that of showing that a species as a whole is in danger, that man's operations are incurring a preventable catastrophe. Depletion from over-fishing is, obviously, very likely to be confused with natural decreases due to things other than over-fishing, or man's demand for food. The ability, then, to distinguish natural fluctuations due to the spawning seasons for instance, should enable us to recognize the results of over-fishing with greater clearness. This is without doubt the most important service to be rendered by a study of the fluctuations.

So we must observe the classes of various aged fish as early as possible, distinguishing them with the greatest possible exactness, in order that the nature of a change in abundance may be known, whether caused by natural fluctuations or by over-fishing. How far this is from realization in all of our species is a striking testimonial to the indifference of man.

To do these things we must know the ages of the fish taken. We must be able to contrast two-year-old fish with those six years old, to recognize the youngest fish, and to be able to tell in what year any individual or class of individuals was born. If we do not know the year of birth we can not trace back the failure of the spawning season to the occurrence of any particular phenomenon or group of phenomena. This means the discovery of the age of the fish, not merely of a particular class, but of the individual, a subject difficult in itself.

We may illustrate the most obvious method of finding the age by comparing the fish on a given bank to an orchard planted at different times. There will be some variation, but trees planted in a given year will approach the same height, and the heights for the successive years will be very different. So if all the trees planted in each year were grouped, we might have well-defined size groups, and anyone looking at them would say, here is the one-year group, here the second, and so forth. And so it is with the fish; they arrange themselves in natural groups, according to the age. But when they become very old, the growth both of the trees and of the fish slackens, so that the difference between those born in different years becomes less than the difference between individuals, and the age can not be told.

But this is a cumbrous method. It could be carried out once in each case, to corroborate other methods, and then abandoned, as has usually

been done. A preferable method is to use the marks left on the hard parts of the fish, just as it is possible to use the rings left in the wood of the tree.

The reason for these marks is thought to exist in the nature of the growth of the fish. Its surroundings govern its growth, just as its temperature depends entirely on the temperature of the water. The seasons modify profoundly all the conditions of its surroundings, and with them the growth of the fish. During the winter months, growth and activity become much decreased, somewhat as those of a lizard or snake do. The tree grows by adding to its trunk a thin layer of woody tissue, and the part laid down during the colder months of the growing

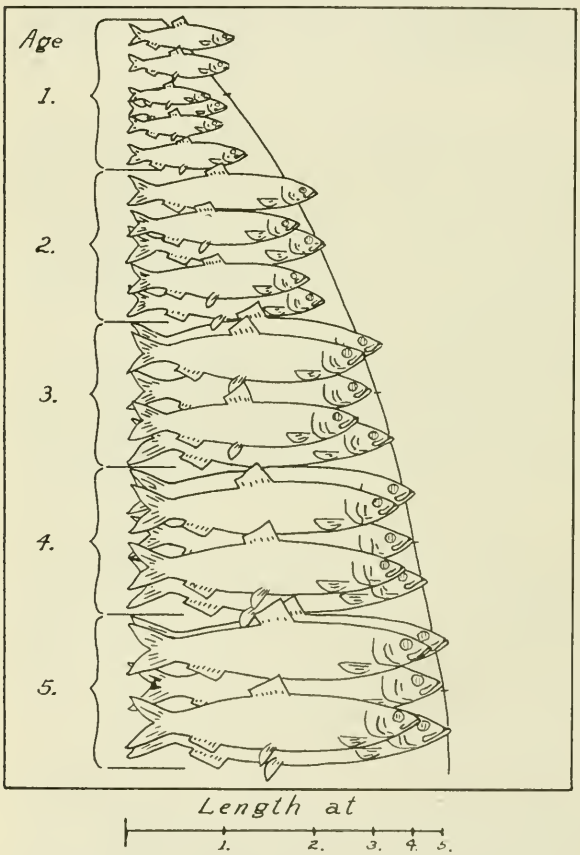


Fig. 19. Groups of fish of various ages, showing distinct difference in size between the early age groups, and the difficulty of distinguishing older ages by size alone. Average length of each group shown on line below, indicating the decreasing rate of growth with age.

season differs radically in structure from that laid down during the warmer. And so it is, presumably, with the fish and its hard parts, such as the scales, the otoliths or ear bones, and the bones of the body and head, although to be sure we can not attribute all the changes to the one condition, temperature, directly. The growth is by addition, leaving behind the old structure to tell the tale of the seasons that are past. Forest trees may tell of fires that have passed their way, of cold years, of warm years, of crowding by other trees, and of all the tragedies of the forest. So in a measure do the scales of the fish tell of birth, of years of plenty and of scarcity, sometimes of spawning, of injury, and

of migration, but through it all there is the tale of the seasons, the fundamental rhythm of existence among the lower animals.

We find that a scale is made up of many small rings, or circuli, but that at certain regions these are closer together, or that there is a mark or break in the continuity of the pattern on the scale. These parts which are thus marked are those in which the growth was affected, or even stopped. So there is a mark on the scale of the fish when it reached its first winter; and what was added during its second and its third summers, is clearly separated by other winter marks. We find that when we read the ages by these scales, the individuals in each of the size groups mentioned above and compared with trees in an orchard, are of the same age, and that the first size group has one annual ring, the second two and so forth, showing that the reading from the scales

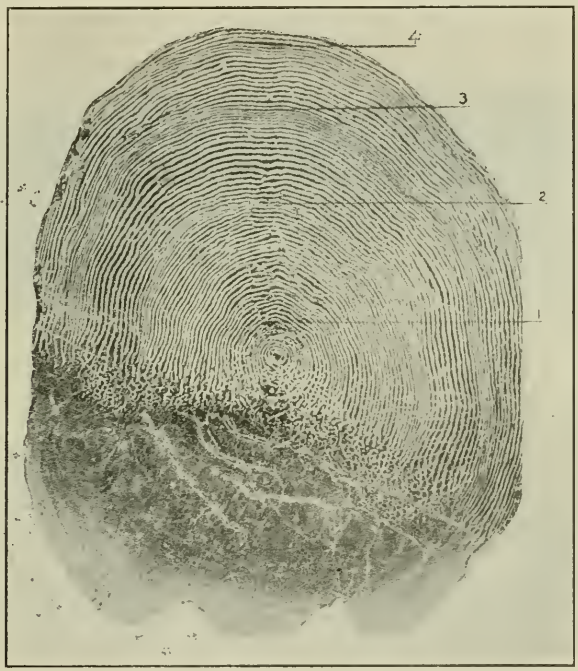


Fig. 20. Scale of Frazer River sockeye salmon, Bellingham, Washington, June 18, 1917, from female, 23 inches long, in fifth year, showing approximated circuli marking the winter growth, the end of which is indicated by a line in each case. (After Gilbert, Rept. British Columbia Commissioner Fisheries, 1917.)

corresponds with the size groups and hence must be accurate. Such a comparison has not been carried out in all species, but in a sufficient number to place the facts on a firm basis.

The same is true of the otolith. It is a calcareous formation in the ear of the fish, which grows by successive concretions. The ear of the fish is not visible from the outside, but is nevertheless well developed, with semicircular canals much like those of men, and in one of the sac-like parts is deposited the otolith. The portions formed during the winters have much less organic matter in them than the layers formed during the summers, and hence are easily distinguishable.

Thus we may know the age of the fish, and know when it spawns, how old it becomes before it dies, and we may know these things regarding each individual. This renders it possible to know in what year fish belonging to an abundant year class were spawned, and under what conditions they were born; therefore, why they were abundant. Without a knowledge of this kind, which would indicate when the results of particular phenomena might be expected to become evident, it is obvious that the careful study of such phenomena is meaningless from the standpoint of the fisheries. The age reading also renders it possible to accurately compare the numbers of fish of various ages, something we could not otherwise do, because if we relied on size groups we would confuse the ten-year-old fish with those nine and eleven years, or even eight and twelve years old. But aside from these more important things, there are, naturally, many things upon which a knowledge of the age throws light. Thus it is possible to prove that fish grow faster in one locality than in another. There is, indeed, much to be worked out,

Fig. 21. Otolith, or ear bone, of halibut, in tenth year, showing dark "winter" zones and white "summer" zones. (After Thompson, Seventh Annual Report, Commission of Conservation, Canada.)

and much to be proved in the case of the individual species, and even in regard to the general principles governing the different species.

In every species the light thrown by a knowledge of age, even when most brightly, is dependent for its importance on a knowledge of whether it is shown for the whole of a species or for merely a small part which may happen to be involved by the fishery. We must know whether the locality is representative, or whether it is isolated from the others. Perhaps we could catch all the fish in one locality and the numbers of fish in other localities would not diminish, there being therefore no danger to the species as a whole. Similarly, the value of protection to a limited area is subject to the same considerations. But, it may well be asked, how is it possible to discover this isolation, when we can not

see below the surface of the waters to watch the coming and going of the fish? It is difficult, but possible, as we shall see.

We know that when a village of men is isolated, and the inhabitants interbreed for a sufficiently long time, a dialect grows up, and ultimately certain physical characteristics seem to mark the inhabitants. The formation of the dialect is a rough measure of the degree of isolation of the group. So it is with a school of fish, or those inhabiting a certain region, their separation from others leads in time to the formation of small peculiarities of habits and structure. If the separation is simply lifelong, perhaps only those characters will be changed which have to do with the amount of food obtained, such as the length of the head and the rate of growth. But if isolation is complete, and has lasted for many thousands of years, there are deeper, more fundamental differences, of habit and structure. These are indications of the degree of isolation.

TABLE 2.

Table Showing Difference in Number of Vertebrae Between Herring From British Columbia and California.*

Locality	Specimens counted	Average of count
British Columbia—		
Point Grey	160	51.8
Pender Harbor	96	51.8
Pender Harbor	281	51.75
Kildonan	305	51.8
Nanaimo	206	51.8
California—		
San Francisco	81	50.7

*From Thompson, "A Contribution to the Life History of the Pacific Herring," Report British Columbia Commissioner of Fisheries, 1916.

Therefore, it has become a well-recognized method of research, to take samples of fish from different regions and to compare them carefully by minute measurements, such as the length of the head, the shape of the skull, and the number of fin rays. The results are sometimes astonishing, for well-recognizable groups may be made out in many species of fish. The implication is always that there is no migration between the groups, that each group has its home waters, to which it is confined, or that it has well-defined habits which keep the stocks separate.

Another method used is to place on the fish silver tags, piercing the fins or the body for the purpose, and then to release the marked individual alive, with the hope of retaking it, or of having a fisherman return it. By keeping a record of where and when the fish was released, it is possible to discover how far it has traveled and at what rate. The trouble, naturally enough, is that the fish, because of the irritation, may travel farther and faster than it ever would naturally, and may perhaps leave "home" when it would not under usual conditions.

Sometimes advantage is taken of the fact that fish from a certain locality may be characterized by marks left on the scales by some local condition. Then the dispersal of the marked group may be traced from

year to year. An attempt has been made to use this method in the case of the herring, and also in the case of the sockeye salmon, where the scales are marked by the character of the growth during the first year or two. In the latter this has led to the identification of the birthplaces.

There are also other methods used of discovering the rate of movement, but none as valid. Thus when fish are abundant in one locality during one season, and abundant in another during the season following, migration is naturally supposed, by many people, to have occurred. In an extreme case of the use of this method, mackerel being abundant in Europe while they were not in American waters, many men drew the conclusion that the mackerel had migrated across the Atlantic. But there was no evidence to show that the disappearances and appearances were not simply the result of great fluctuations in the success of the spawning seasons. The dangers of such conclusions should be obvious, particularly when the imperfection of any known measure of the real abundance of the fish, such as the returns from particular methods of fishing commercially, is known. There were also at one time theories that the herring of European waters lived around the North Pole, and that they came down from the Arctic seas in great armies, the German *Heere*. These armies, or schools, were supposed to move around England and return to the far north. Now it has been proved that the herring of the Baltic, of the English Channel, of Iceland, and other localities, are of separate stocks which intermingle but slightly, if at all, and that they do not migrate in any such fashion. The method used to discover the truth was that which has just been mentioned of measuring the physical characteristics.

On the whole the tendency is to discredit migrations of great extent, but there are several marvelous migrations well known. Certainly the eel, which lives in fresh water, goes into mid-ocean to spawn. And just as certainly the salmon of the Pacific comes in out of the sea and passes up rivers thousands of miles long to spawn at the headwaters. But the quick assumption of long marine migrations, as that of the albacore into Mexican waters, is certainly to be deprecated. It is so easy to postulate complex migrations to explain varying appearances of fish in different localities in different seasons that to every species is ascribed such movements by the fishermen, with all the certainty in the world. But it is better, without doubt, to suspend judgment until actual facts from other sources are at hand to corroborate such theories.

It should be evident from what has been said that there is much to learn before over-fishing may be ascertained, or its extent judged. The problems to be met are large ones, yet not insuperable. The application of the acquired knowledge in order to prevent depletion is a considerable problem in itself. Over-fishing may always be stopped by restricting the fishery in any way, however crude and harmful the restriction may be, but the application of measures which will so distribute the restriction as to do the least harm to the fishery and the most good to the species is a different matter. Primarily, it is possible to restrain the fishery wherever it imposes its greatest drain on the supply, with a good chance of effectiveness; but that might not be the best available method. The most general principles underlying the subject are, as a matter of fact, unknown or undiscussed, despite the many legal measures passed by the legislatures.

We may ask, for instance, why the spawning season should be so persistently an object of protection. The eggs are slowly developed throughout the year, indeed throughout the life of the individual, and the death of a female in January certainly destroys as many eggs as its death in June, if the spawning season comes in June. The matter would seem to be one of securing the survival of an adequate number of individuals throughout their normal lifetimes, so that there would be enough of them to produce eggs. But that implies care that too many young are not taken, just as it implies care that too many adults are not taken. In short, the value of the individual at the various times of its life must be known, so that it may be used when it is of the least value to the species and of the most value to the fisherman. We are still far from such a knowledge of biology as that implies.

The impression that it is sought to convey throughout this paper is that in order to conserve our fisheries, there are many problems to be solved, all of them important. Among them that of the adoption of statistical methods having for their object the ascertainment of the abundance, rather than the amount taken, easily comes first. But such a substitution can not be made without a knowledge of biology to supplement and guide it. And the biological phases of fishery science are in themselves many and important, dealing as they do with the rate of growth and the movements of the fish. Then finally, there is almost no adequate knowledge concerning the methods of conservation, or the prevention of depletion. We are at the threshold of a period of exploitation of our fisheries and we must be sure that we begin an era of scientific investigation of our fisheries in time to adequately guide and control the exploitation.

The dependence of the statistical method and biological study upon each other necessitates their prosecution by an agency capable of giving the investigation its needed scope. Adequate statistics can be gathered by a government only, and the same is true of the biological data required. The responsibility therefore rests upon the state, in whose hands lies the legislative control of the fisheries.

THE BASSES AND BASS-LIKE FISHES OF CALIFORNIA.

Families Serranidae, Haemulidae, and Kyphosidae.

By EDWIN C. STARKS, Stanford University, California.

The basses are the most fish-like fishes, so to speak, for they represent more than others the typical spiny rayed fishes. They have been usually selected as types of fishes for books of anatomy and textbooks since the time the great French zoologist, Cuvier, so used the yellow perch early in the last century.

All of the families of bass-like fishes group about the central family, Serranidæ. They and the mackerel-like fishes apparently were descended from a common ancestor. Also related to the basses are the croakers, though less closely than any of the fishes here included.

It is not at all desirable to here discuss the technical characters that define these fishes. It is sufficient to say that the first dorsal fin is made up of spines, the ventrals are placed but little behind the pectorals and joined to the shoulder girdle internally, the anal fin is usually with three spines, the ventrals with one spine and five soft rays, and the scales

rough with little spinules on their margins. This last may be appreciated by passing the finger over the scales in the direction of the head.

Representatives of this group occur everywhere in fresh and salt water, except in the Arctic regions. They are very numerous in the tropics and often very brilliantly colored. Among them are some of the largest of bony fishes as well as some of the smallest, ranging downward from the giant sea basses to the pigmy sun fishes and darters, some of which are fully grown at a length of between one and two inches.

KEY TO THE BASSES AND BASS-LIKE FISHES OF CALIFORNIA.

1. The vomer with teeth. A small portion of the upper edge only of the maxillary hidden by the bones just above it (preorbital bones) when the mouth is closed.
   2. Side of body with well-marked lengthwise stripes. *Striped bass. Roccus lineatus.* Page 62.
   2–2. Side of body without well-marked stripes.
      3. Spines of first dorsal shorter than rays of second. The two dorsals not much united. Size very large. *Black sea bass or Jewfish. Stereolepis gigas.* Page 62.
      3–3. Longest spines of first dorsal as long or longer than the rays of second. The dorsals broadly united. Size not excessively large.
         4. No small round spots on head or body. The third dorsal spine not over twice as long as the second and a little shorter than the fourth. The preorbital bone at its narrowest part scarcely over half as wide as the diameter of the eye. *Rock Bass or Sand Bass, Paralabrax clathratus.* Page 66.
         4–4. Numerous small round spots scattered over the head, or head and body. The third dorsal spine at least three times as long as the second, and longer than the fourth. Narrowest part of preorbital about as wide as eye.
            5. The small round spots confined to the side of the head, and usually some are on side of tail just in front of the caudal fin. *Johnny Verde or Kelp Bass. Paralabrax nebulifer.* Page 68.
            5–5. The small round spots scattered over the head and almost the entire body and fins. *Spotted Kelp Bass or Cabrilla, Paralabrax maculatofasciatus.* Page 67.

1–1. The vomer without teeth. A considerable part of maxillary slipping under bones just above it, when mouth is closed.
   6. Pectoral fin pointed and reaching past tips of ventrals.
      7. A dark band extending downward from middle of spinous dorsal. Base of pectoral black. Third anal spine shorter than second. *Sargo, Anisotremus davidsoni.* Page 63.
      7–7. No dark band downward across body, but several dark stripes running lengthwise on body. Third anal spine longer than second. *Big-Eyed Bass, Xenistius californiensis.* Page 64.
   6–6. Pectoral fin rounded and not reaching past tips of ventrals.
      8. No scales on gill cover behind preoperculum. Each tooth divided into three points. Dorsal and anal rounded in outline. *Greenfish or Opal Eye, Girella nigricans.* Page 65.
      8–8. Gill cover fully scaled. Teeth single pointed. Dorsal and anal rising to an angle in front, straight edged or slightly concave along tips of rays when fin is spread, and sharp pointed behind as tip of last ray. *Half-Moon Fish. Medialuna californiensis.* Page 66.

GLOSSARY.

Anal fin: The unpaired fin along the lower side of the body.

Caudal fin: The tail fin.

Dorsal fin: The fin along the back. Sometimes separated into a first and second dorsal, the first part, whether separated or not, composed of spines in these fishes.

Fin rays: The softer elements that stiffen the fins. Differing from spines in not being sharp. They are usually branched like those that make up the second dorsal in these fishes.

Fin spines: Stiffer than rays, sharp at the tip and unbranched.

Head: The head is measured from the tip of the snout along its side to the edge of the gill cover.

Lateral line: A line of pore bearing scales along the side of the body. In these fishes it is more or less arched upward and follows the outline of the back.

Maxillary: The flattened bone just above the mouth and just above and behind the premaxillary.

Opercle: The gill cover just behind the preopercle.

Pectoral fins or *pectorals*: The fins just behind the gill openings, one on each side of the body.

Premaxillary: The bone bordering the upper jaw that bears the teeth.

Preopercle: The bone just behind the cheek that forms a ridge downward across the gill cover and turns at an angle forward.

Preorbital: The bone just in front and below the eye. It reaches downward to the maxillary and its surface is covered with thin membrane.

Snout: That part of the head in front of the eyes.

Ventral fins or *ventrals*: The pair of fins on the lower side of the body under the pectorals.

Vomer: A single unpaired bone that lies in the roof of the mouth directly behind the middle of the upper jaw. Do not mistake the palatines for it. They lie one at each side of the vomer parallel with the side of the jaw, and may or may not bear teeth.

FAMILY SERRANIDÆ.

The Striped Bass (Roccus lineatus).

This well-marked fish may be at once known by the dark horizontal stripes on the body, teeth on the vomer, a spine at the angle of the gill cover, and the pectoral fins not longer than the ventrals and not reaching

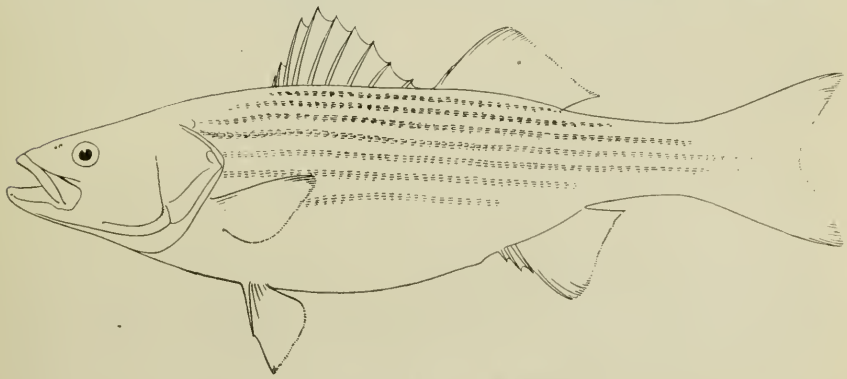


Fig. 22. Striped bass (*Roccus lineatus*).

so far back. There is another fish on our coast that has such stripes, but they are not so well marked and it lacks the above combination of characters. The eye is three or four times wider than the narrowest

part of the preorbital just below it. The maxillary reaches to below the middle of the eye. The mouth is armed with rather fine sharp teeth. Scales extend on top of the head to in front of the eyes. The edge of the preopercle is divided into many small sharp spines. The dorsal fins are separate from each other and about equal in height. The second dorsal and anal have a sharp angle at the tips of the first rays. The middle caudal rays are shorter, making the outline of the fin concave.

The color is silvery with brassy and coppery reflections, and marked with seven or eight blackish stripes, one of which is along the lateral line.

The striped bass, though not a native member of our coast, is one of our important food fishes. It was introduced from the Atlantic coast and has become abundant. It is caught to the limit of safety to the species, and being a much advertised fish it commands a high price. Though it is without question a very fine food fish, it is rather overrated. This fish reaches a weight of 80 or 90 pounds, and one was once reported on the Atlantic coast that weighed 112 pounds.

The Black Sea Bass or Jewfish (Stereolepis gigas).

This gigantic fish may usually be known by its size. The body is broad and robust, and covered with rather small scales. The top of the head between the eyes is wide and not very convex. The eyes are small, several times shorter than the length of the snout or the space between them. In small ones the edge of the preopercle is divided into spines, but the edge becomes nearly entire in large ones. Fine teeth are in broad bands on the jaws. The dorsal fins are separate, and the first one is composed of short, stout spines that are shorter than the rays of the second dorsal. The pectorals are rather round in outline, and reach past the tips of the ventrals. It is very dark brown or nearly black in color.

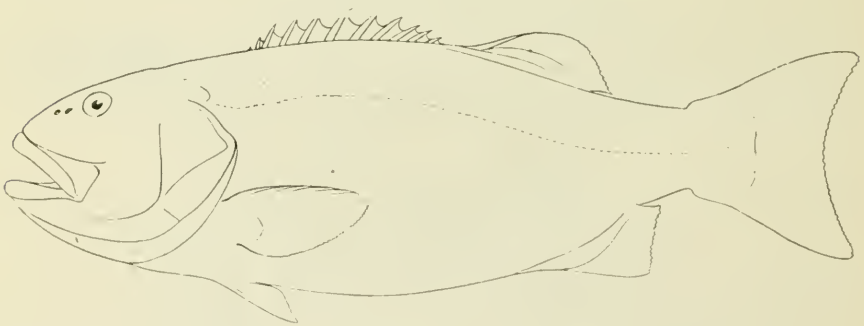


Fig. 23. Black sea bass or jew fish (*Stereolepsis gigas*).

This huge fish is rather abundant in southern California, and it is taken as far north as the Farallone Islands. It reaches a length of six feet, or sometimes even more, and a weight of 500 or 600 pounds. A considerable amount of its flesh, cut in large chunks and salted, finds a ready market. Its flesh, however, is not of the best, being rather coarse grained. Those of small or moderate size are said to be better than the large ones. It is a famous fish among the anglers of big game fishes, and monsters of nearly 500 pounds have been taken on tackle unbelievably light. Related to it is a huge jewfish of the south Pacific that is said to reach a length of 12 feet.

The accompanying drawing is a composite reconstructed from several photographs, all of which show the fishes hung by the lower jaw and the head much distorted. The photographs show considerable variation in the depth of the body as compared with the length, and a marked variation in the relationship of the anal fin below the soft dorsal. In some the two fins end evenly behind. In others the anal projects much farther backwards.

Rock Bass or Sand Bass (Paralabrax clathratus).

As in the other members of this family the vomer is rough with small teeth, and the hind part of the upper edge of the maxillary is but little hidden under the preorbital bone just above it. The third dorsal spine is about twice as long as the second and scarcely as long as the fourth. The eye is twice as wide as the bony part of the preorbital space just below it. Small, fine spines are on the edge of the preopercle bone, and a flattened spine is just in front of the soft flap at the edge of the gill cover. It is steel-gray below with the upper part of the side mottled and barred with broad blotches of dark color with silvery gray between. The fins are all tinged with yellow. There are no small, round, dark spots on the head or body. Fig. 24.

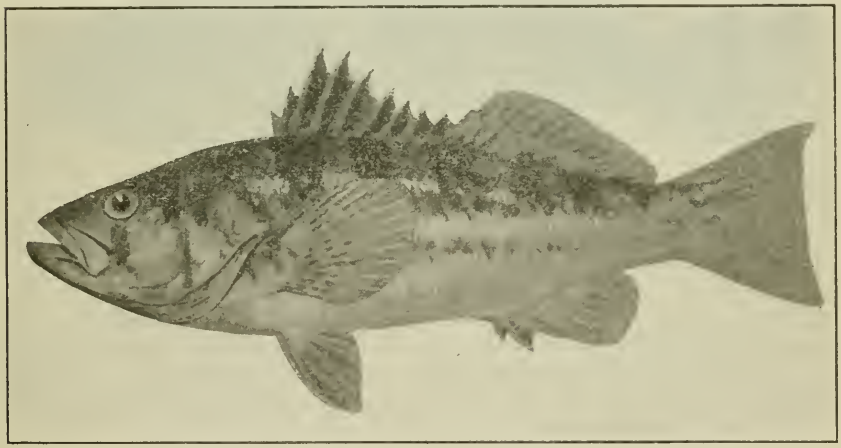


Fig. 24. Rock bass or sand bass (*Paralabrax clathratus*).

This bass is an excellent food fish. It reaches a length of 19 or 20 inches and a weight of 5 pounds. It is found from San Francisco southward along the Lower California coast, and is most abundant below the Santa Barbara Channel. This and the other two species of *Paralabrax* are all known as rock bass, kelp bass, and cabrilla without distinguishing between them. I have more or less arbitrarily restricted the use of these names in the hope that the species may be more consistently distinguished from each other by common names.

Kelp Bass or Johnny Verde (Paralabrax nebulifer).

This bass may be known by the small, round, dark spots on the side of the head, particularly below and in front of the eye, and, usually, on the side of the tail just in front of the caudal fin. The teeth on the

vomer and the relative covering of the maxillary by the preorbital is as in the rock bass. The third dorsal spine is considerably more than twice as long as the second and is longer than the fourth. The eye is as wide as the bony part of the preorbital space just below it. The spines on the edge of the preopercle and the flat spine on the gill cover do not differ much from those of the rock bass. The small scales on top of the head extend forward to opposite the front of the eyes. The ground color is solid greenish to under the middle of the second dorsal, behind which the color of the back and side is irregularly broken with short wavy lines. The under parts of the body are pure white. On the front of the body are some traces of irregular dusky bands extending down and back. The first dorsal has a large dusky spot in front, and the anal fin is a bright slate-blue. The cheek and region below the eye are covered with small round golden or yellowish-brown spots. Fig. 25.

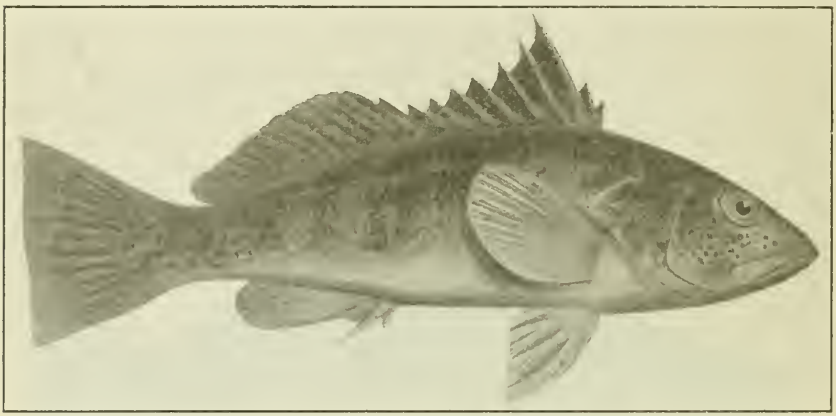


Fig. 25. Johnny Verde or kelp bass (*Paralabrax nebulifer*).

This bass is a very good food fish, differing little in this respect from the rock bass and spotted kelp bass. It is rather abundant on the coast of southern California, and has been occasionally taken as far north as Monterey Bay, while southward it extends its range along Lower California. It reaches a length of about 18 inches.

Spotted Kelp Bass or Cabrilla (Paralabrax maculatofasciatus.)

The spotted bass may be at once known by the small spots that everywhere cover the head and body and extend over the second dorsal and caudal fins. In common with the other members of the family Serranidæ the vomer is rough with fine teeth and the maxillary is only slightly hidden by the bones above it. It resembles the kelp bass (*P. nebulifer*) and differs from the rock bass (*P. clathratus*) in having the third dorsal spine longer than the fourth, and the eye as wide as the preorbital space below it. It differs from the kelp bass in color, and in having the fine scales on top of the head not extending forward beyond the middle of the eyes. The color is greenish-brown covered over with small, round, dark brown spots very close together. These extend onto the soft dorsal, caudal and anal fins. On the side of the head the spots are smaller and tinged with golden color. Six or seven dusky bars extend down from the back across the body. On these the

spots are darker and more or less run together. A dusky-bluish streak extends from the eye down and back across the cheek. Fig. 26.

This is one of the very few shore fishes found on our coast that extends its range southward as far as Mazatlan, Mexico. It has not been reported north of the Santa Barbara Channel. It reaches a length of 18 inches and as a food fish ranks with the other two basses of the genus *Paralabrax*.

Fig. 26. Spotted kelp bass or cabrilla (*Paralabrax maculatofasciatus*).

FAMILY HÆMULIDÆ

Sargo (Anisotremus davidsoni).

The sargo is a deep bodied fish that may be at once known by the dark band that extends down across the body, and the dark spot on and above the pectoral base. The mouth is small, slightly sloping from the horizontal, armed with fine teeth set in bands, and with thick, fleshy lips. When the mouth is closed the lower jaw scarcely projects beyond the upper. The maxillary, which is considerably covered by the bones above it, scarcely reaches back to under the front of the eye. The edge of the preoperele is armed with small spines. The base of the spinous dorsal is longer than the second dorsal. The dorsals are connected, and the longest spines are longer than the longest rays. The base of the anal is short, or scarcely equal to more than half the distance from the anal to the base of the ventral spine. The caudal is somewhat forked, or deeply concave behind. The pectoral is long and pointed, about as long as the head and reaching well past the tips of the ventrals. Color grayish-silvery, dark above with many dark points. A black cross-band extends down from the middle of the spinous dorsal across the side to a point on a level with the pectoral base. The base of the pectoral is black, with the black extending some distance upwards and touching the edge of the gill cover.

This fish ranges from San Pedro southward along the Lower California coast. In the summer time it is reported to be not uncommon about San Diego and the Santa Barbara Islands. It reaches a length of somewhat over a foot.

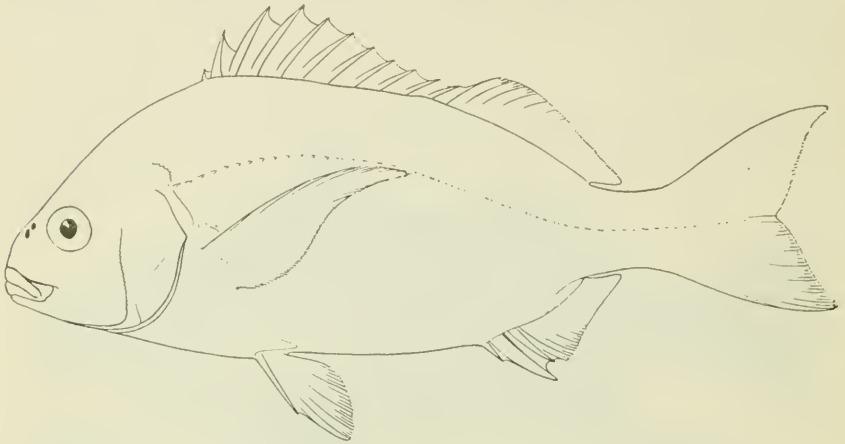


Fig. 27. Sargo (*Anisotremus davidsoni*).

Big-eyed Bass (Xenistius californiensis).

This is not a true bass, but belongs to the related family Hæmulidæ. It has no teeth on the vomer, and a considerable portion of the maxillary is covered by the bones just above it. It somewhat resembles the striped bass in the shape of the fins and in having stripes lengthwise of the body, but the stripes are not nearly so conspicuous. The eye is very large; its diameter greater than the space between the eyes on top of the head, and about equal to the distance from its front margin to the tip of the lower jaw when the mouth is closed. The mouth is moderate in size, very oblique, and with the lower jaw projecting beyond it in front. There is no flat spine pointing backwards at the hind angle of the gill cover. The maxillary reaches to opposite the front of the large

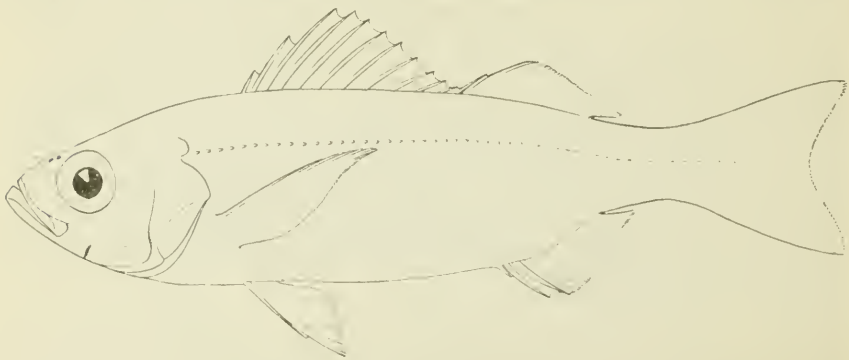


Fig. 28. Big-eyed bass (*Xenistius californiensis*).

pupil. Fine spines are around the edge of the preopercle. The pectoral is pointed and extends farther back than the ventral fins. The first dorsal is rather triangular in shape, almost separated from the second dorsal, and is composed of rather stiff spines. The second dorsal resembles the anal fin. The scales feel very rough when the finger is passed over them in the direction of the head. The color is bright silvery, bluish above. Six or seven dark orange-brown stripes run lengthwise of the body.

The big-eyed bass reaches a length of about a foot, and is found from southern California southward along the Lower California coast. It is reported to be sometimes common about San Diego.

FAMILY KYPHOSIDÆ.

Greenfish or Opal Eye (Girella nigricans).

The greenfish has a bluntly rounded head and a moderately deep body. Small teeth are in bands on the jaws, attached to the membrane only and freely movable. Examination with a magnifier will show that each tooth is divided into three points. The maxillary is entirely hidden under the bones above it, leaving only the premaxillary in sight when the mouth is closed. The maxillary scarcely reaches to below the front

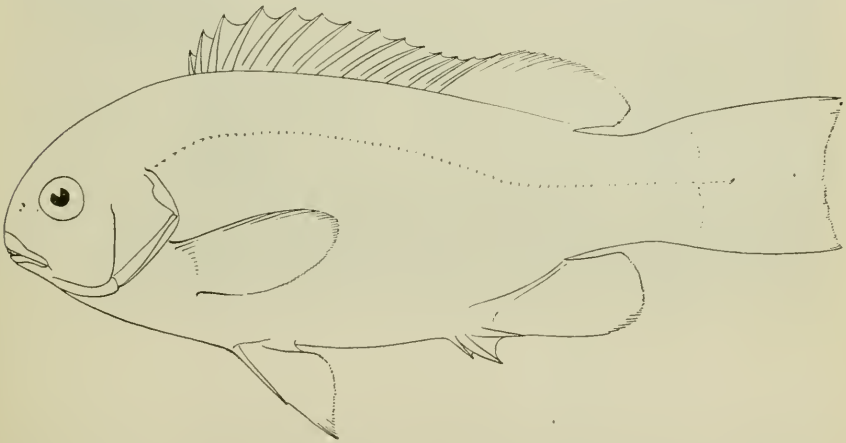


Fig. 29. Greenfish or opal eye (*Girella nigricans*).

of the eye. The edge of the preopercle is not divided into fine spines, and behind it the gill cover is devoid of scales. The spinous dorsal is much longer than the soft dorsal and broadly attached to it. The spines do not decrease much in length towards the last ones, and the longest ones are about as long as the longest rays. The rays of the anal fin are about as long as the base of that fin. The pectoral is short and rounded, nearly as long as the head, and scarcely reaching as far back as the tips of the ventrals. The caudal fin is slightly concave. The color is olive-green, paler on lower parts, the fins dusky greenish. Small ones have a yellowish spot on the back, and the fins have bright blue borders. The blue color quickly fades when the fish dies. The eye is a beautiful opal blue and green, hence the name, opal eye, that is sometimes applied to it. It is also called bluefish and blue-eyed perch.

The former name should be discouraged as it is not related to the famous bluefish, and the latter is doubly unfortunate, for it is neither a perch nor related to the fishes on our coast that we wrongly call perches. The name was doubtless given it from a fancied resemblance to the false perches, but aside from the shape of the body, it has nothing in common with them.

Though the greenfish is herbivorous, feeding very largely on sea weed, it will bite a hook baited with a bit of clam or abalone. It scarcely exceeds a foot in length, and when fresh is a food fish of very good quality, but its flesh is rather soft and does not keep well. It is found in abundance from San Francisco southward to the coast of Lower California. Small ones are very abundant in tide pools.

Half Moon (Medialuna californiensis).

The half moon is a compressed deep bodied fish that may be known from its relatives on our coast by the complete covering of fine scales that extends over the anal and second dorsal fins, and to a less extent over the caudal. The mouth is small, slightly oblique, and armed with fine even teeth set in broad bands. The maxillary scarcely reaches back to below the front of the eye. The lower jaw scarcely projects

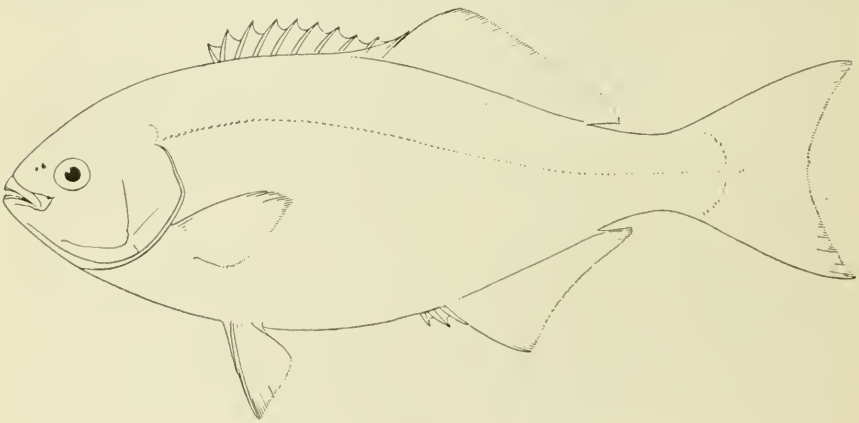


Fig. 30. Half moon (*Medialuna californiensis*).

beyond the upper when the mouth is closed. The edge of the preopercle is thin, membranous, and not divided into fine sharp points. The first dorsal is connected with the second and is very much lower, the longest spines being little longer than the diameter of the eye. The anal is shorter than the soft dorsal but resembles it in shape, being highest in front, where it rises to an angle and sharp pointed behind at the tip of the last ray. The caudal is evenly concave behind. The pectoral is rounded, much shorter than the head, and not reaching nearly so far back as the tips of the ventrals. The color is dark steely gray, lighter below, and more or less mottled, all of the fins are dark, and the dorsal and anal nearly black.

This fish is very beautiful in its lines and color. It is taken in considerable abundance about rocky places on the southern California coast, and is reported to be a very good pan fish. It reaches a length of about a foot.

BEAR HUNTING WITH BOWS AND ARROWS.

By SAXTON POPE.

For some years back a number of us in San Francisco have been hunting with the bow and arrow, purely for sport. A powerful bow is an effective weapon, but it takes months of practice to be able to shoot it well. Such a bow pulls 75 pounds.

Having killed rabbits, quail, squirrels, bobcats, skunks, foxes, and deer, we naturally wanted to try our hand on a bear. We knew that a bear is a hard animal to kill even with a gun, but we also knew that the Indians killed him with a bow. So we wanted to find out just how much there was to the game. Our friends of course were very skeptical. They said that an arrow would hardly go through his hide.

Fig. 31. Black bear killed with bows and arrows by Arthur Young and Saxton Pope of San Francisco in Panthen Canyon, Humboldt County, California.

We got in communication with Thomas Murphy of Blocksburg, Humboldt County, who hunts bear as a business. He has been at this sort of thing for thirty years and never fails to get about a dozen bear every winter. So we packed up our strongest bows and several dozen broadhead arrows, and Arthur Young and I went up to Blocksburg.

Murphy was willing to let us shoot at a bear, but he insisted upon carrying a gun in case of accidents. He said he didn't want to lose a valuable dog over the affair.

After four unsuccessful hunts, we at last treed a good-sized bear up a tall fir. After securing the dogs, Mr. Young and I took our stand about thirty yards from the base of the tree, on the sidehill, and let drive two arrows at one time. Both shafts struck the bear in the chest, going completely through, feathers and all.

Quick as a flash the bear wheeled about and began descending the tree. We ran up close and shot him again as he neared the ground, and bounded down the hill. Murphy turned the dogs loose, and they all went crashing through the brush together.

Pretty soon we heard them bay him again, and we rushed a quarter of a mile down the canyon to find him sitting on the limb of another fir, holding on like a man. We shot again and he dropped to the ground, where the dogs heeled him and went flying past hanging on to a hind leg. The bear immediately mounted a nearby oak, not over eight inches in diameter, and swung out on a limb. At close range, we shot arrow after arrow through his chest while he slipped further out on the bending limb, and at last fell to the ground, rolling over and over down the canyon. The dogs were on him in a second, and by the time we reached the creek bed, the bear was dead.

Murphy performed the autopsy, giving the hounds the liver and lights. Eleven arrows had gone through the beast, seven of these through the chest. The lungs were collapsed and pulmonary hemorrhage finished him. The first two shots would have been enough if we had waited.

It was a three year old female black bear, weighing about 150 pounds. That it was no larger was no fault of ours. The arrows cut ribs in two at several points and undoubtedly could have penetrated any beast with a hide less resistant than a hippo or an elephant.

NOTES ON THE ARTIFICIAL PROPAGATION OF THE SPINY LOBSTER.

By P. S. BARNHART, Scripps Institution for Biological Research.

Because of its possible bearing on the future artificial propagation of the spiny lobster, *Panulirus interruptus*, I think it might be worth while to make a record of the conditions under which eggs were hatched and the young carried through the phyllosome stage of development.

It has always been easy to secure berried lobsters and obtain from them the first stage of the young. These have always died before passing through further stages of development, even though kept in fresh running sea water, supposedly under ideal conditions.

B. M. Allen working under the auspices of the California Fish and Game Commission in 1911, constructed elaborate hatching boxes at the inlet to False Bay, where a plentiful supply of fresh water was constantly available and the water in the boxes kept in constant agitation by means of a rotating wheel. In his published notes (1916) he says:

"There is no difficulty in securing the young. It is only necessary to impound spawn-bearing females. The young hatch very readily even after the spawn-bearing parent has been kept in captivity for weeks. Attempts to rear them, however, proved futile. Their extreme delicacy and pelagic habit make their culture an especially difficult problem."

On May 14, 1918, a berried lobster was placed in a large concrete tank, 6 by 9 feet, in the research aquarium of the Scripps Institution. This tank contained approximately 800 gallons of water. A small jet furnished about 5 gallons of water an hour. The 20th of June two green turtles weighing about 30 pounds each were placed in the same tank. Every few days after this quantities of a green alga was thrown in for the turtles to feed upon. Much of this rotted and accumulated in

one corner of the tank under and around a lot of large stones where the lobster kept itself hidden.

The in- and outflow from the tank was not enough to keep the water perfectely fresh and it began to take on the milkly hue indicative of bad water. This finally became so bad that I decided to clean the tank out. On the 10th of July I started to do this, but where the sun struck the water I noticed that there was a slight movement on the surface as of many small animals moving about. I immediately made a haul with a fine net and was much surprised to find quantities of phyllosomes. Many of these were put into fresh running water where they remained alive for several days, but gradually died off. Those remaining in the large tank kept alive about eight days when they also died. As far as I was able to observe these were in the small, first phyllosome stage.

This experiment might indicate that, while bearing and hatching the eggs, the adult seeks comparatively quiet water where there is much decaying vegetation. It surely proves that fresh clean water is not necessary for their hatching and development to the phyllosome stage. Allen found that spawn-bearing females usually "seek sheltered spots in the lea of islands or points of land and take refuge in sheltered crevices of rocks alongshore."

I hope to repeat this experiment this year on a much larger scale.

IS THE HERRING GULL INSECTIVOROUS?

By A. C. BURRILL, Idaho Station Entomologist's Office.

Some individuals doubt that gulls naturally eat insects. They consider that the blowflies reported eaten by gulls (Dr. Dutcher, President of National Association of Audubon Societies), were merely gulped down when some gull seized a beached fish on which the flies might have been ovipositing. This seems probable and also that some other insects eaten, as the white grub's adults, the May beetle, may have been washed up on shore alongside fish and so included with the bigger mouthful, even if the young gulls were being fed by their mothers at the time. (By the Wayside, Feb., 1912, p. 42.)

In The Auk (v. 19, p. 46), Doctor Dutcher saw at the No-Man's-Land Gull Reservation, Maine, young gulls which, as soon as able to leave the rookery, went in flocks to neighboring grass and potato fields and ate immense numbers of grasshoppers and potato beetles. This doesn't look like mere beach scavenging, does it? Yet I agree that many insects can be easily swallowed unintentionally by scavenging gulls. In the summer of 1910, I related in a recent note how the gulls cleaned up the fish driven ashore on Lake Michigan, Whitefish Bay, Wisconsin. At that time there were thousands of beetles, largely ladybirds (Coccinellids) of many kinds, along the beach, besides various other unfortunates, so that a gull would have great difficulty in cleaning a fish body of all of the smaller fry before swallowing.

Owing to the lack of material, former Chief Henshaw says, our Federal Biological Survey has made very few stomach analyses of this species. But just lately Dr. A. S. Alexander called to my attention a Scottish work (Transactions of the Highland and Agricultural Society of Scotland) in which in 1912 is given the analysis of 616 Scottish bird

stomachs, including 44 herring gulls (the same as ours, *Larus argentatus* Gmel.). This seems to accord so well with the little known here that I venture to quote in the words of the author, Miss Laura Florence, Carnegie Scholar in the University of Aberdeen, published at Edinburgh: "*Summary*: 15 contained fish; 3, carrion; 13, shells; 4, refuse; 1, brittle star; 4, crustacea; 3, insects of injurious group; 2, insects of indifferent group; 3, earthworms; 3, potatoes; 9, grain; 14, grass; 9, seeds." Again, she lists the food for a single male shot at Donmouth in Aberdeen, Oct. 31, 1910: "Stomach about quarter full; fragments and husks of grain; fragments of chitin; forceps of an earwig (Forficuliadæ); grass." The chitin mentioned may have been other parts of the same earwig or some other insect. This work was supervised by the well-known zoologists, Professors J. Arthur Thompson and J. W. H. Trail.

Fig. 32. Herring gulls on breeding grounds, No Man's Land, North Carolina. Photograph by Herbert A. Job.

Thirty per cent of these gulls, therefore, ate fish, but the amount of fish material must have been much less than that. Compare Mr. Henshaw's statement regarding American gulls: "The herring gull can be considered a fish eater only to a very limited extent. Occasionally, we have found the remains of fish in the stomach contents, but there has always been collateral evidence that the fish were eaten in the shape of offal. When about harbors and inland waters, its principal food consists of garbage. We have a number of stomachs collected in Maine by Dutcher, and these contain the remains of June bugs and other insects with about 10 per cent of fish garbage, showing that the herring gull is in some localities and to some extent, at least, insectivorous."

In Leslie's Weekly, for Sept. 5, 1912, there is a view of the American battleship "Utah," near Galveston, Texas, surrounded by sea gulls

picking up refuse. In an earlier issue, February, 1909, is another of gulls picking up fish from a school of herring on the high sea. This is more often true of the kittiwake gull or of the stormy petrel, alias "Mother Carey's Chicken," well shown in Collier's Weekly for Sept. 6, 1913 (p. 15), though Mabel Osgood Wright says the name herring gull was given this bird "because as they were originally fishermen by trade, their presence flying above the water told where schools of herring were to be found. Today the schools of herring are less plentiful along our shores, and the value of this gull, though greater than ever, is due to a different source." Now gulls act as scavengers, becoming "the health officers of the coast" (November, 1907, The Herring or Harbor Gull, Educ. Leaflet No. 29. The Nat. Ass. Aud. Soc., N. Y. City).

Mr. Brann (By the Wayside, January, 1912), claims gulls still dive for fish occasionally in Green Bay, Wisconsin, but Mr. Henshaw rather disputes this for the United States as a whole, and so writes friend W. T. Davis, a careful observer and naturalist of Staten Island, New York Harbor (letter, Dec. 31, 1912). One of the best refutations of much fish being eaten by gulls came out in the Pall Mall Gazette (Feb. 6, 1912), Mr. F. G. Aflalo saying:

Fig. 33. Sea gulls flying over headlands, La Valle, California. Photograph by L. Hugo.

"The public mind is constantly being misled on this subject of the destructiveness of gulls by journalists with a passion for statistics. Only the other day a morning paper published what purported to be the pictorial menu of a sea gull during the year. It was shown in terms of a great line of barrels of herrings, 146 barrels, each containing 500 herrings, to a total not far short of 200 pounds sterling. There were two very obvious fallacies in this reckoning. In the first place it assumed that the whole of the 73,000 herrings thus consumed as fry, would have grown to maturity if the gull had left them alone. To put it mildly, this is by no means proved; to put it frankly, it is rubbish.

Moreover, this imposing cartoon gave no hint of the tons of offal and garbage which, to the great benefit of many a harbor, these feathered scavengers consume every year. The picture told, in fact, what was not true, and suppressed what was."

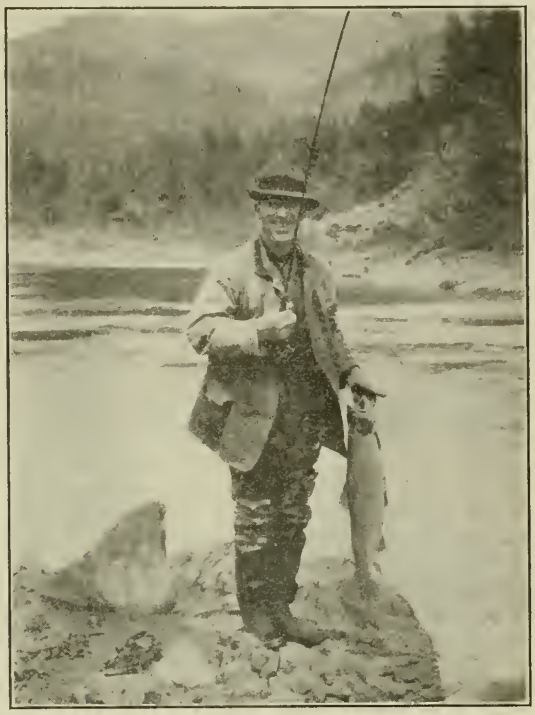
Mr. C. W. Creel, in charge of the cereal and forage insect investigations laboratory of the United States Bureau of Entomology, at Forest Grove, Oregon, informs that often, when the farmers are plowing in the Salt Lake Valley, Utah, gulls come in large flocks to work over the land, whether after insects or field rodents would be a very interesting line of investigation. Likewise we have a photograph of many gulls visiting plowed land in California, and suppose that this is the California gull. However, it will be interesting to hear from other observers, if the herring gull, which is less common there than in other parts of America and Europe, still shows sufficient interest in plowed fields in California to associate with the California gulls in their field patrols.

One species of gull flies up the Columbia River and has been reported in spring as far up the Snake River Canyon as Lewiston, Idaho, per Adjutant General Charles Moody, showing that even inland Idaho, though lacking large lakes, may be within the flying zone of this valuable species. In the Big Bend country of eastern Washington, some of the farmers who were worried by the large armies of coulee crickets in the spring of 1918, were discussing if there would be any advantage in shipping a few pairs of gulls to the desert country to eat up these crickets and thus attract more gulls to fly in from the coast, and thus repeat the well-known tale of the Mormons and the Mormon crickets of Utah, and the deliverance effected by the gulls. Further data is invited.

Messrs. B. G. Thompson and M. M. Reeher, special field agents of Mr. Creel's office, have furnished the following details. Mr. Thompson was sent into the grasshopper afflicted district near Burns, Harney County, Oregon, May, 1918, where he met a Mr. McGee who said that for several years gulls had been working on grasshoppers. Messrs. Thompson and McGee went out to look for a new band of hoppers in May and after a long hunt saw at a distance about a thousand gulls feeding on the land. Mr. McGee felt sure that they would find the hoppers near there, and on going over to see, found the gulls so gorged that they would hardly get out of the way. The gulls were busily picking up the young hoppers. Mr. Reeher was sent into Langells' Valley, near Klamath Falls, Oregon, early in June, 1918. His guide told him that a few gulls visited the hoppers the year before, and showed him this June, 1918, about five hundred gulls feeding on hoppers. We have no data as to what species of gull this was, save that it was white with bluish slate-colored wings, which answers to at least three species. As the California and ring-billed gulls breed in colonies on Klamath Lake, it seems reasonable to believe that birds of these two species were implicated.

These facts are given to show that gulls may be quite as well worth study in the West as in the East, and their protection quite as necessary.

FRANK A. SHEBLEY.



The death of Frank A. Shebley, one of the oldest employees of the Fish and Game Commission, which occurred in a hospital in Yreka, December 21, 1918, came as a profound shock to scores of friends. Although he had been unconscious for seven hours after the accident to the auto bus in which he was riding between Fort Jones and Yreka, several days before, on Saturday morning there was every indication that he would get well, but a sudden change which occurred late in the afternoon ended in death.

Frank Shebley was born in Nevada county nearly forty-seven years ago. He was the son of California's first famous fish culturist, and had succeeded before his death, in company with his brother, William H. Shebley, in making a reputation as great if not greater in the same line of endeavor than that of the father, who had gone before. As a boy, he followed farming on his father's place, but for the past twenty-five years has been identified exclusively with fish culture in connection with the California Fish and Game Commission, and there are few men on the Pacific slope who knew as much about fish and fishing in the waters of the rivers and bays as Frank Shebley knew. During his experience with the Commission he was the superintendent of the Price Creek hatchery in Humboldt county, and the Brookdale hatchery in Santa Cruz county, and recently the new Mount Whitney hatchery in Inyo county. Under his management the Brookdale hatchery became very popular and was sought out by sportsmen from all over California as a place of great interest. Also interested in angling as a sport, he was a master of the fly rod and a skilled angler. In recent years he had given some attention to land investments, as well as mining ventures, and with W. P. Netherton of Santa Cruz was the owner of considerable property in Texas.

Few employees of the Fish and Game Commission have been so universally loved as has Frank Shebley. His genial personality and perpetual good humor won for him hosts of friends. His loss will, therefore, be a personal one to many. Mr. Shebley's fish cultural attainments furnish assurance that the vacancy left by his death will be hard to fill.

CALIFORNIA FISH AND GAME

A publication devoted to the conservation of wild life and published quarterly by the California State Fish and Game Commission.

Sent free to citizens of the State of California. Offered in exchange for ornithological, mammalogical and similar periodicals.

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All material for publication should be sent to H. C. Bryant, Museum of Vertebrate Zoology, Berkeley, Cal.

April 21, 1919.

"Conservation deals with those things to which practically every normal person turns for relaxation in his moments of leisure."

OUR MAILING LIST.

The mailing list for CALIFORNIA FISH AND GAME has been entirely revised. Those who did not take the trouble to sign the card enclosed in the October number have been removed from the list and a new written request alone will replace them.

There have been so many additions to our mailing list of late that the edition published has had to be increased. This, in connection with a marked increase in cost of printing, leads us to speculate as to the possibility of continuing free distribution. It may well be that some small charge will have to be made for the magazine in the future. If this change becomes necessary, we will but be following the lead of several other states. A regular subscription list would allow a great saving in postage in that the magazine could then be mailed as second-class matter.

PENDING LEGISLATION.

Less important fish and game legislation has come before the present legislature than for many years past. The bills that have been introduced are less radical in nature and notably less in number. The few relating to game which stand out as desirable are: A bill granting discretionary powers to the Fish and Game Commission which would allow better administration of fish and game resources; bills making the state laws conform with the new federal regulations; and one remodeling the districting act to include two new game refuges, an area in the vicinity of Mt. Breckenridge, Kern County, and an area on Mt. Hamilton, Santa Clara County.

Desirable changes in the law requiring fishways are provided for in two bills, and it is hoped that another bill prohibiting fishing within two hundred and fifty feet of any fishway or screen will be passed. An important bill provides for the inspection of all imported fish eggs or fish so that undesirables may be quarantined.

Among undesirable bills relating to game are those which provide bounties on predatory birds and on predatory mammals, one opening the bear season in districts 2, 2A and 10, one opening the season on rabbits in the above districts, one providing for the repeal of the hunting license law, and one providing for the sale of ducks killed when destroying rice. A bill to permit the use of a spear in taking trout in certain local districts and a pernicious shrimp bill are among those relating to fish which would tear down present protective laws.

It seems reasonable to believe that our legislators will look with disapproval on those bills which are adverse to the best interests of our fish and game, and will stand by those tending to uphold protection and conservation for our wild life resources.

FISH AND GAME COMMISSION INAUGURATES EDUCATIONAL WORK AT SUMMER RESORTS.

Believing that a better knowledge of wild life will bring about better conservation of it, and that when people are on their summer vacations they are most responsive to education on wild life resources, the California Fish and Game Commission, backed by the Nature Study League, will institute this coming summer a series of lectures and nature study field trips designed to stimulate interest in the proper conservation of natural resources. The Tahoe region has been selected for the work this year. The work will be offered at six different resorts. The month of July is the time set. All lectures and classes will be open

to the public and no fees will be charged. Illustrated lectures on the game birds, song birds, mammals and fish will furnish evening entertainment, and early morning trips afield will give vacationists an introduction to mountain wild life.

Everyone wants to recognize the plants and wild things encountered on the summer vacation. There is no better way of developing this ability than to accompany one who knows the trees, birds and mammals. Special attention will be given the identification of birds by call, song, color and habits. The motto of these classes will be: "Learn to read a roadside as one reads a book." Knowledge of wild life insures better conservation of it. Special excursions for children will be conducted.

These nature study lectures and field trips which compose the vacation camp work of the Bureau of Education, Publicity, and Research of the California Fish and Game Commission are designed to bring about a healthy interest in the out-of-doors and in wild things that through knowledge proper public sentiment and proper conservation of our natural resources may be brought about. In other words, "conservation through education" is the end being sought.

PRESERVE GAME RESOURCES.

California's natural resources in fish and game, with its incomparable climate, its 26,212 miles of fishing streams, its 862,000 acres of lakes and every stage of climatic conditions to be found out of doors, are a gigantic magnet drawing people from remote corners of the earth. California should be the mecca for the human race. The remarkable development of road building of the past few years, with the development of the automobile, have brought the people in touch with this wonderful fish and game asset.

To hunt and fish is as natural to the California boy and girl as to breathe. The farmer and land owner is practically the breeder and raiser of our game and he is ever zealous in its protection. His children hunt and fish whenever the season and opportunity offer. Not a family exists in our rural districts that does not own, as a family heirloom, a shotgun or a rifle, and both sexes of the children are taught their use. They can teach many an expert the fine art of angling in the stream that flows by his home.

There in the rural districts you will find the nucleus of the strong, virile generation that Northern Europe knows so well and that will come after us, for they live much in the open, where they learn self-reliance. Let us not remove from them the natural opportunity to improve their physical being, but rather assist them by conserving our natural resources in fish and game.

Continued changing and revising the fish and game laws will do more toward decimating our fish and game than all the hunters and fishermen can possibly do. The State Fish and Game Commission is a state body directing and supervising the entire work of fish and game protection, propagation, distribution and conservation. Thus the state is administered as a unit and a maximum degree of protection can be given. This could not become an actual possibility were each of the fifty-eight counties given full and complete control within their respective borders. With fifty-eight separate and distinct districts, ranging from a mere handful of population to half a million, each endeavoring to handle the affairs of each for themselves and not one for the other, one can easily imagine the chaotic state of affairs that would result. Thus one can realize why experimental legislation would be and is more detrimental to the unsurpassed fish and game interests of California than all her hunters and fishermen, alien and domestic.—Editorial, Sacramento *Union*, Feb. 16, 1919.

LARGE PROFITS WITH SLIGHT OUTLAY.

Few, if any, natural resources of a state are administered with so slight a cost to taxpayers as is fish and game. Wild birds, mammals and fish yield a splendid annual return in food and sport, to say nothing of their help in controlling pests, and this wild life does not need food or shelter, but simply reasonable protection. Not one dollar is appropriated by the state for its maintenance. The small burden falls entirely upon those who make most use of the resource. The hunters and anglers of this state by paying a small license fee of $1.00 furnish

the funds used to enforce fish and game laws and initiate protective measures. Many persons are ignorant of these facts and these are the ones that continually complain of the high cost of fish and game administration.

"NOW BEGINS THE SEASON."

"Now begins the season of the year when the weary city man turns his face from the familiar crowds and noises of the city to the country places: where he may fish in the trout streams; plod over the hills with a gun on his shoulder in the hope of shooting something; dabble in the ocean waves at the beaches; or sleep all night on the hard ground, with queer noises going on in the woods around him, curious little insects walking over his body and tickling him, curious little animals tiptoeing around among the leaves, and unknown dangers, remembered from his primitive days, waiting to catch him and gobble him up."—San Francisco *Bulletin*, June 30, 1914.

It is good for a man to wander back at intervals into the domain of old Dame Nature. What good does it do? It means quickened pulse, hearty appetite, an inexpressible tingle of exhilaration in every nerve, better poise, greater resiliency of step, augmented power of body and mind for the battles of the workaday world.

What element is more important in making insistent the call to marsh, field, and mountain than that furnished by the wild life? Exterminate the game and you make the world drearier, more monotonous, less interesting. Exterminate California's game and you turn one of the most attractive of the sisterhood of states into a desolate waste.—*Western Wild Life Call*, No. 4.

CONVICTION MADE UNDER FEDERAL MIGRATORY BIRD TREATY ACT.

Los Banos and other San Joaquin points have heretofore supplied most of the ducks for the market. Changed conditions have moved the activities of market hunters to Colusa, Sutter and Yuba counties. The city of Colusa, being in the center of operations, became the rendezvous of most of the market hunters. The fact that the Migratory Bird Treaty Act prohibits the sale of all waterfowl made no difference to these men who shoot for money.

The difficulty of detecting sale transactions is evidenced by the following facts: One of the most notorious hunters maintained a joint in Colusa where ducks were dispensed after the password had been given. So notorious had the place become for the distribution of ducks that traveling men had no difficulty in purchasing them at any time. It was the custom of these men to keep a supply of ducks on hand in order that they might guarantee the limit to so-called city "sportsmen" whom these hunters took out at so much per day. The surplus ducks were shipped to San Francisco and Sacramento under fictitious names to be distributed by agents.

The proprietor of this joint, with three other well-known market hunters, was detected on October 15, 1918, the day previous to the opening of the season, with 226 ducks and one snipe in his possession. Information was filed against these four defendants, Charles Guernsey, J. T. Maley, Frank Chambers, and Joe P. Meyers. They were indicted by the Federal Grand Jury and were tried by jury on February 4, 1919, at Sacramento, Judge Van Fleet presiding. The jury returned a verdict of guilty in eleven minutes, and the defendants were sentenced to pay $100 each or in default serve 60 days in jail.

Much credit is due state and federal wardens Carpenter and Ludlum, Deputy United States Game Warden E. S. Cattron and Assistant United States Attorney Johnson for the manner in which the case was handled. As this was the first case in California under the Migratory Bird Treaty Act, Judge Van Fleet did not impose a maximum fine, but warned all future offenders to beware.

GEO. NEALE.

MENDOCINO RANCHER MAKES GOOD KILL.

Mr. Frank Williams, a sheep rancher of Calpella, Mendocino County, recently succeeded in killing a black bear which had been killing sheep in the vicinity for several years. It weighed 300 pounds. A mountain lion was killed the same day. (See Fig. 32.) During the winter of 1913 seven lions were killed in this vicinity.

Fig. 34. Mountain lion and large black bear which had pestered sheep-men for years at last rounded up in one day by Frank Williams, a rancher of Calpella, California. Photograph by Una Boyle.

GAME LAWS TO BE ENFORCED IN NATIONAL FORESTS.

Persons who violate the state game law on national forests now become liable to prosecution in the federal courts. A regulation recently issued by the Secretary of Agriculture is as follows:

"The going or being upon any land of the United States, or in or on the waters thereof, within a National Forest, with intent to hunt, catch, trap, wilfully disturb or kill any kind of game animal, game or non-game bird, or fish, or to take the eggs of any such bird, in violation of the laws of the state in which such land or waters are situated, is hereby prohibited."

BEAVER HIDES CONFISCATED.

Deputies Newsome and Sellmer, while on patrol work along the Tuolumne River, discovered 14 green beaver hides in the camp of a trapper. The trapper, fearing the hand of the law, had fled. If the attempts being made to locate the trapper are successful, prosecution will follow.

DEPUTY ACQUITTED AT TRIAL.

Deputy Carpenter of Maxwell, Colusa County, was recently made defendant in a suit to compel payment for seventy-three ducks which he seized from three Colusa market hunters. The commission's attorney, R. D. Duke, handled the case in a masterly way when it came to trial by jury at Colusa on February 11. Attorney Duke contended that the justice had no jurisdiction in the case and that it should be tried by a federal court, but he was overruled by Justice of the Peace, Moore. Nevertheless, the outcome was a verdict in Deputy Carpenter's favor. This vindication of the game laws by a jury in Colusa augurs well for the future.

WAR-TIME SAVING IN COST OF FISH FOOD.

The furnishing of proper food to the millions of fish reared in our hatcheries is no small problem. Until the cost made it prohibitive, beef liver was largely

used in the preparation of fish food. With the increase of cost wholesale in San Francisco from 5 cents to 12 cents per pound, it became necessary to seek a substitute. This was found in refuse fish costing but 4 cents per pound. A product of a fish reduction plant known as cracklings has been found usable, but hardly as satisfactory as beef liver.

THE PACIFIC COAST WHALE INDUSTRY.

It is reported that in 1918 the principal whaling company on the Pacific Coast, with stations in Washington, British Columbia and Alaska, took 999 whales, of which about 200 were of the set species (*Balaenoptera borealis*), whose meat is light colored and particularly good for canning. One right whale was captured; it yielded 1,600 pounds of excellent baleen. Four samples of this baleen, 8 to 9 feet in length, have been sent to the bureau for exhibition purposes. The short baleen of the common shore whales, which in recent years has been thrown away, now has a fair market value, and large quantities of the discarded material are being profitably salvaged.—*Fisheries Service Bulletin*, No. 45.

FOOD ADMINISTRATION REGULATIONS ON FISHING NO LONGER EFFECTIVE.

All of the rulings of the Federal Food Administrator regarding the commercial fisheries of the state, with the exception of that relating to the packing of sardines, were revoked on December 31, 1918. The laws of this state are now in full force and effect as they were previous to the rulings of the Food Administrator.

MORE BIRD TREATIES NEEDED.

Conservationists having successfully provided for the protection of migratory wild fowl which breed to the north of the United States are now demanding a similar protection for the waterfowl and insectivorous birds which summer in the United States, but spend the winter season in Latin America, where they are wantonly slaughtered. As a sample of the type of destruction which goes on in Mexico, we quote from a letter written by H. S. Battie of Hollywood, California:

"Regarding the market shooting, I refer solely to ducks; except the egret, no other feathered game is shot for the market.

"As you may not have heard of the methods of shooting ducks for market, I will explain it.

"In the table lands of Central Mexico nearly all the large haciendas have ponds or lakes to catch water during the rainy season which is later used for irrigation. During the winter the ducks congregate in immense numbers on such places.

"At a convenient place on the bank a frame of heavy timbers is laid, and to these are fastened batteries of guns—anything that will shoot, in some cases iron pipe being used. They sometimes have three tiers, fan-shaped, one above the other, and perhaps a hundred or more guns, the first aimed at the water, the second slightly above, and the third slightly higher still. These are fired by trains of powder.

"On the day selected the peons go in boats, and also wading, gradually driving all the ducks on the lake into a compact mass in front of the battery. At a signal the boats back away and the peons duck under. The first tier is fired as the birds are sitting and the other two a fraction of a second later as the birds are taking wing. The slaughter is dreadful. I would not care to say just the number, but an American friend who happened to be at an hacienda at the time, told me they got two thousand that day. I had no reason to think he exaggerated."

While interest is still strong regarding the protection for migratory and insectivorous birds effort should be made to give the summer visitant class of birds equal protection with the winter visitants. Not only will the carrying out of such a program of protection be a benefit to the citizens of today, but will be a benefaction to the coming generations.

CONSERVATION OF FISH.

Former visitors to Santa Catalina Island, who remember seeing tons of albacore, tuna, and black sea bass spoil on the pier and then towed out to sea, will be interested in reading the report of the Avalon Fish Exchange. All fish caught by anglers and not utilized by them becomes the property of the Fish Exchange. This supply is augmented by market fishermen. Last season 165,000 pounds of edible fish were shipped to the mainland. This was in addition to the large amount sold on the island. Included in the shipments to the mainland were 92 giant bass, fish which formerly went to waste, but which now are in great demand. Anglers trolling in Catalina waters used

15,000 flying fish as bait. Valuable data as to the time of year when the different varieties of fish are in abundance is being accumulated by the exchange.

DEPENDABLE INFORMATION IS NEEDED.

Honorable George D. Pratt, Conservation Commissioner of the state of New York, has recently called attention to the need for precise and dependable information about wild life resources. He points out that the underlying cause for the multiplicity of laws relating to game offered at each session of the different state legislatures is inadequate information regarding game conditions. In attempting to fill this need, Mr. Pratt instituted in 1915 a game census designed to furnish a running check upon the condition of the state's wild life. By leaving out of consideration unprovable assertions or estimates based upon guesswork or the unreliable method of averaging, the census gives definite knowledge regarding general abundance of different species in different sections and the fluctuations in their condition from season to season. Each of the 140 field men have been required to report upon cards every week all of the game that they have seen and the conditions under which that game was existing during that week.

On the deer card, spaces are provided for recording the number of bucks, does, and fawns, damage to crops, distribution, physical condition and food supply. Other cards provide for data regarding game birds and waterfowl, fur-bearing animals, and predatory animals and birds, with appropriate remarks. As a result of a study of the deer cards, it has been possible to draw definite conclusions regarding relative proportion of the sexes and the extent to which they are breeding.

As a means of gathering additional statistics, every holder of a hunting license when applying for a new license will hereafter be required to give in addition to his name, residence, personal appearance, etc., the amount of game that he killed under his old license. This will give an approximate measure of the amount of game actually killed and will give a basis for demonstrable facts. With these facts at hand, wise laws can be maintained on the statute books, and changes will be brought about only as rapidly as actual changes in the condition of wild life justify modification of the law.

When Vermont inaugurated the same system it was pointed out that the value of such a census would be threefold:

1. The warden force will be educated in local conditions and brought into closer harmony with the sportsmen.

2. A basis for wise legislation will be secured for the protection and conservation of a resource of real value in terms of dollars and cents.

3. The educational value to our people as increasing their interest in, and cooperation with, the work of the Department of Fisheries and Game.

STATE GAME DISTRICT 1K.

In connection with the Sequoia Park extension bill introduced in the present session of Congress, which proposes to extend the present boundaries of the Sequoia National Park to include the South and Middle Fork canyons of the Kings, it is worth while, perhaps, to consider the effect that the passing of this bill would have on the game situation in the Sierra and Sequoia National forests, and particularly on the State Game Refuge 1K between the north and middle forks of the Kings.

Nearly one-third of the area of Game District 1K is within the boundaries of the proposed park extension, and as other areas suitable for the propagation of game are also included, and the park regulations do not permit hunting within the national parks, it is only reasonable to suppose that some action may be taken to try to have the present game district abolished, on the grounds that the park will amply provide for all the game protection needed in this part of the mountains.

The fact will still remain, however, that no other area is so favorably situated with regard to ideal conditions for winter breeding grounds as the low brushy southern exposures in township 12 south, range 28 east afford. Because of the rough nature of the country and its inaccessibility, there is little probability of attempted poaching, and while a park would provide protection and ample range during the summer season, I believe it would be a serious mistake if the above-men-

tioned township at least is not retained as a game preserve where hunting is prevented at all seasons.

It might be argued that the closed season during the winter months offers all the protection that is necessary; but it would be found, I believe, if the game preserve were abolished, that a large number of hunters would flock to this area in the open season, on the assumption that by this time the deer would be working down from the higher elevations where they had been protected in the park and possibly tamed to some extent.

One other consideration is the open bear season of November and December that offers a legitimate excuse for hunting parties in the brush at that time of year. That is the one time when poaching might be carried on, for only a few hunters could resist the temptation to kill some of the numerous bucks they would undoubtedly see, especially since the chances of detection are so small without the continuous presence of a game warden in the vicinity. It would seem much safer to cut out every excuse for legitimate hunting in these breeding grounds.

ROY BOOTHE.

IS THE PORCUPINE WORTH SAVING?

Evidence that we have not yet standardized our game laws is apparant in the different viewpoints taken by the states of New York and Minnesota regarding the porcupine. The New York Conservation Commission classifies the porcupine as "vermin" and enumerates twenty as having been killed during January, 1919. The state of Minnesota, on the other hand, protects the porcupine on the theory that the animal furnishes an easily obtainable source of food to anyone lost in the wilds.

MANICURE THE BIRD-CATCHING CAT.

Dr. Wm. H. Dall, of the United States National Museum, recently pointed out a method that will save our cats and thoroughly protect the birds against their attacks. It is a well-known fact that these animals only seize their prey through the use of the claws on the forefeet. These claws are, as we know, so organized anatomically that when at rest they are retracted, but when brought into play they are thrown forward, so that their sharp points may be instantly employed in the act of seizure. No cat ever attempts to catch a wild bird in the open by employing its hind feet, or the claws upon them. No lion, tiger, leopard, or any of the rest of the big felines in nature ever do. This also holds in the case of pet cats who kill the canary in its cage, or capture the fish in the globe or aquarium.

When one comes to think this over, it soon becomes clear that, were cats deprived of their claws on their forefeet, they could not catch a bird of any kind, however hard they tried. The claws have no more feeling in them than have our finger-nails, to which they really correspond. Cat claws can be trimmed just as we trim our nails, and the best tool to do it with is the small cutting pliers used by jewelers. Anyone can use such a tool, and with a little practice anyone owning a pet cat can readily trim all the claws on its forefeet. All there is to be done is to gently press the foot from above, downwards, between your thumb and forefinger, when the claws will be thrown forward. They should be snipped off a trifle back of their middles applying the cutting edges of the nippers to their sides. A little dressing with delicate file afterwards will also prove advantageous. A cat so operated upon can not possibly catch and kill a wild bird or a pet bird in a cage; nor can it destroy fish in any receptacle in which we may keep them. Moreover a cat with its claws so trimmed can not climb a tree; it is up in trees that they catch many birds, as they likewise do by running up poles topped with bird boxes and bird houses of every description. After the claws are trimmed the foot looks precisely as it did before the trimming was performed—that is to say, nothing unsightly results.

Some will say that it prevents the cat from catching mice. Well, what of it? There is not one cat in a hundred that catches mice for any purpose; moreover, a few mousetraps of modern models will very quickly rid house, barn, and outhouses of all description of mice. Any of the "cyclone" pattern of traps will do it in a few weeks. Cats with trimmed claws can enjoy their milk and other food just as well as with untrimmed ones, so there is no cruelty done along such lines.

Finally, were we to trim the claws in the manner indicated of all claimed cats, and destroy all cats not claimed by anyone, we would save thousands of insectivorous birds annually; and surely the country has by this time begun to realize what the insectivorous birds mean to the farm and agriculturist generally. A federal law should be enacted to enforce what is indicated in this matter, and be so framed that, when passed, it would be in the highest degree effective.—*Ill. Audobon Soc. Bull.*, 1918.

A PLAN TO CONSERVE WYOMING ELK.

After a very careful investigation of the problems presented by the herds of elk on the National Forests adjacent to the Yellowstone National Park, Henry S. Graves, chief forester, and E. W. Nelson, chief of the Bureau of Biological Survey, have suggested a plan, based on sound biological principles, for conserving this valuable game animal. They propose the maintenance of the present herds, estimated to number from 40,000 to 45,000, and the use of the annual increase for legitimate hunting and distribution to build up other herds. The maintenance of these herds is to be accomplished by the acquisition by purchase or exchange of private land to provide needed additional winter forage, and the setting aside of adjoining areas as game refuges, the progressive extinguishment of sheep grazing privileges to prevent any possible conflict between wild life and domestic stock, the enlargement of the present government ranch in Jackson Valley to provide forage during severe seasons, a vigorous campaign against predatory animals that destroy elk, and state legislation requiring hunters to report the number and kind of animals killed and to preserve and make economic use of the meat. In addition, it is pointed out that a special study of the migratory drift and winter and summer habits of the elk to supply certain facts now in doubt should be instituted.

FUR FARMING IN ALASKA.

The United States Bureau of Fisheries in a recent bulletin (Document 847) gives interesting information regarding fur farming in Alaska. Reports are given on the success attained by no less than 25 different breeders. Fur farming in Alaska is concerned almost wholly with the breeding and rearing of foxes, but some attention has been given to minks and martens, and there are records of martens having been born and reared in captivity in the territory. Although skunks and raccoons have been introduced into Southeastern Alaska, nothing is known as to the success attained.

The history of fur farming in southeastern Alaska is with but few exceptions a history of failures rather than successes. Three good reasons for the failures can be advanced: one, neglect due to irresponsible men left in charge; two, discouragement following failure of the industry to prove a "get-rich-quick" proposition; three, lack of experience and knowledge in handling fur animals. Nevertheless, the opportunities for the fur farmer in Alaska are almost unlimited.

HOW DO BIRDS FIND THEIR WAY?

A lecturer at the California Academy of Sciences on January 15 discoursed on "How Migrating Birds Find Their Way." This lecturer upset all my previous notions that instinct had anything to do in guiding birds on long journeys, and gave numerous instances to prove that birds followed previously observed currents of air and water in their flight, or rose and depended upon sighting distant landmarks through their well-known powerful vision.

As a lover of birds and a former breeder of homing pigeons (usually called carrier pigeons) my observation leads me to believe that the orienting instinct of birds is innate, on the same principle that, biologically, plant and animal life is governed by the influences of light and heat. I cite a case in our late war of bird travel under difficulties. A Lake County man began to raise homers (carriers) for the United States Army in France. Anxious to try out his stock he sent a male fledgling to my home at 1125 Bush street, San Francisco, in a little collar box with a few holes perforated in the cardboard. Wheat lay on the bottom of the box, but the bird was cramped and did not eat it on the rough stage trip from the mountains. When it arrived, it had nothing in its crop and it should have been nurtured, but next day it was taken from the dark box, a quill fastened to its leg

with date, hour, and minute, and released. It barely made the fire wall of the five-story apartment house next door, and sat stretching one leg and wing, then the other, preened its feathers, lifted its head to one side, then the other, rose, circled a few times and darted north. Being of good homing stock, I thought we should hear from it next day, but three weeks passed, then came word that the bird had got home, worn, bedraggled, with a .22 bullet wound through its breast and wing, over which the blood and feathers had matted or had been stuffed in the wounds by the bill of the bird. The wounds were weeks old.

Now, how did the bird exist, and how did it find its way—a young bird, its first flight after a seventy-five mile trip in a dark box, from which it never gleaned sight of a landmark to guide it home to the Switzerland of America if not by some inherent trait? Can CALIFORNIA FISH AND GAME readers elucidate?—JOHN OLIVER TITLOW.

A SUGGESTION FOR CALIFORNIA CONSERVATIONISTS.

It may be of interest to those concerned with the conservation of wild life in California to note that the state of New York number of game and fur-bearing animals ing of additional information as to the number of game- and fur-bearing animals killed in that state. The *American Field* for December 28, 1918, page 593, states that:

"Beginning January 1 all applicants for hunting and trapping licenses in New York State will be required to make a statement of the game and fur-bearing animals which they took under their license for the previous year if they had one.

This information will be tabulated on the stubs of the licenses, which are retained by the town and village clerks and will give to the Conservation Commission accurate information of the greatest value regarding the food and game resources of the state.

Statements of their 1918 catch, which sportsmen make when securing their 1919 licenses, will necessarily be from memory, but to assist them in keeping track of what they take during 1919 a neat little tally card will be supplied when the licenses are taken out, upon which the sportsmen can keep a record during the year.

Both license and tally card will be handed to the applicant in a stout manila envelope, in which he may carry them in the field and keep them clean throughout the year."

It is believed that this suggestion will appeal strongly to Californians. As the tendency toward reduction in the numbers of game and fur-bearing mammals becomes more noticeable, it is fortunate that public opinion is insisting more and more upon scientific administration of the fish and game resources of the state. It is evident that a common sense program of this sort is dependent upon adequate information, and it seems that the method suggested is one which gives promise of valuable results. The writer has been advised by Dr. T. S. Palmer that the method has been given a partial trial by one or two of the provinces of Canada and a similar number of states. The chief difficulty in regard to it is in connection with enforcement. Changes in residence and failure to appreciate the necessity for definiteness in the record are among the complicating factors. It is believed, however, that the adoption of a measure of this sort would be a long step in the right direction. In California this would be particularly true with reference to the fur-bearing mammals, concerning the numbers of which taken during any one season adequate information is not available.—WALTER P. TAYLOR, Biological Survey, Washington, D. C.

THE GAME BIRDS OF CALIFORNIA.

The Game Birds of California (Contribution from the University of California Museum of Vertebrate Zoology) by Joseph Grinnell, Harold Child Bryant, and Tracy Irwin Storer: University of California Press, Berkeley, 1918. Large 8vo., pp. x–642, 16 colored pls., 94 figs. in text. Cloth, $6.00 net.

The volume of the above title is the comprehensive book on the game birds of California that sportsmen, nature lovers, and serious students of bird-life have long needed. The book aims to supply the naturalist with complete information to date regarding the life histories of California birds, to give the hunter useful facts concerning the birds he wishes to shoot, to furnish the legislator with helpful suggestions relevant to the preparation of game laws, and to give the conservationist information which will aid

him in his efforts to perpetuate bird life. The authors took into account all four of these classes of readers and selected and arranged their material accordingly.

Every one of the 108 native game birds of the state is described in detail, these including the ducks, geese, swans, ibises, cranes, rails, snipe, sandpipers, curlew, plover, quail, grouse, pigeons and doves. The localities in which each is found, and the times of the year when it is found, are designated and its life history and habits are accurately described.

The extensive collections and field notes in the California Museum of Vertebrate Zoology, supplemented by previously published knowledge from the experience of ornithologists throughout the West, have formed the basis for the volume. To this groundwork has been added material obtained from interviews with numerous reliable sportsmen and directly from the fresh field experiences of the authors themselves. The whole is worked into what constitutes a practically complete summary of our knowledge of each of the species down to date. The authors do not claim that the book contains everything that ought to be known about each of the game birds of California; far from it, for more extended observations are certain to provide multitudes of new facts. This book should act as a stimulus for future observers, leading them to add to what is now made common knowledge regarding our game birds.

The joint authorship of the book is the working out of the principle that the highest plane of scientific output is likely to be reached only through co-operative effort. When one author works alone, mistakes are made unawares; but when two, or better three, are at work, one is able to check another's work to advantage, and an increased measure of accuracy is the result.

An underlying incentive for the publication of the present work was found in the decrease of many valuable species of game birds and the apparent apathy of the public with reference to instituting proper measures to conserve them. The book adequately treats of the means to be taken to conserve game and makes practical recommendations suited to each species.

Introductory chapters are devoted to general subjects, as follows: Decrease of Game and its Causes; Natural Enemies of Game Birds; The Gun Club in California; History of Attempts to Introduce Non-native Game Birds; The Propagation of Game Birds; Legislation Relating to Game Birds in California. The sportsman and nature lover will find much of immediate utility in these general chapters.

The technical matter useful to the special student of birds is found condensed in small type at the head of each discussion. This makes reference to the finer characters of each species easy, and at the same time segregates this formal matter from the more readable text following.

The plan of treatment of each bird follows a regular sequence: Technical portion (in small type): Accepted common and scientific names; other names; description: adult male, adult female, juvenile, downy young; marks for field identification; voice; nest; eggs; general distribution; distribution in California. Text (in large type): General and local distribution; migration; field marks; life history: nest, eggs, young; habits and behavior; food; economic value; present and probable future status.

"The Game Birds of California" is well illustrated with line drawings and colored plates. Thirteen of the sixteen colored plates were made by the well-known artist, Louis Agassiz Fuertes, and the other three by Major Allan Brooks, now of the Canadian army. In all, twenty-one different game birds are figured in color. The 94 line drawings serve largely to illustrate characters of plumage, bill, or feet, such as are especially helpful in identifying the different kinds of game birds.

As a sample of what may be expected in the treatment of each species, attention may be called to the chapter on the Valley Quail. Twenty-three pages are utilized in describing the bird, its nest, eggs, distribution, field marks, habits and behavior. Here will be found interesting evidence to show that the male birds act as sentinels. A compilation of data on time of nesting and size of clutch occupies over four pages. It is demonstrated that the valley quail lays more eggs than any other game bird, and under normal conditions suffers corresponding mortality.

Means of controlling this mortality are suggested. A discussion of the agricultural bearing, early hunting for the market, and present and probable status of this upland game bird concludes the chapter.

All through the book especial attention is given to those distinctive characters of a bird that help to make it recognizable from other species when alive, at a distance. A useful field manual is thereby provided. A dependable key to the various species makes possible the identification of any specimen in hand. The index contains all the common as well as the scientific names, thus making it easy to locate any bird, provided some name is known, even though this name be a very local, popular one.

Every school and library in the western states should contain a copy of this work for reference use, for more and more is the natural history of bird life assuming importance as a subject of general popular culture. Individuals interested in the fascinating field treated in this work should waste no time in securing copies.

PASSENGER PIGEONS REPORTED IN EASTERN STATES.

Apparently the death on September 1, 1914, of Martha, a twenty-nine year old passenger pigeon kept in captivity in the Cincinnati Zoological Gardens, marked the extinction of the passenger pigeon. At least for several seasons thereafter, a prize offered for the discovery of a passenger pigeon's inhabited nest failed to disclose any pigeons.

During 1918, however, several persons reported seeing passenger pigeons. Baymen and oystermen of Great South Bay insist that a few pigeons still migrate along the southern shore of Long Island, New York.

According to a letter published in SCIENCE, Messrs. Rasmussen, Wilson and Sanders, of Amsterdam, New York, encountered a flock of passenger pigeons on October 1, 1918, while on a bird-study trip in the vicinity of West Galway and Charlton, New York. One of the birds lighted within a few feet of the party, and Mr. Rasmussen, who has been studying birds for 25 years, declares that there is no possible doubt of the identification.

The latest report is from John M. Crampton, 61 years of age, and Superintendent of the Connecticut State Board of Fisheries and Game. He describes having seen three passenger pigeons in the middle of May, 1918, while fishing at Graniss Pond, Southington, Connecticut. He maintains that he had no difficulty in identifying them, for he has been acquainted with the appearance and habits of the passenger pigeon since early boyhood, having been 13 years old when he first shot passenger pigeons, and having had a trained passenger pigeon for a pet for a long time. On June 2, 1918, a Mr. Wooster, who was told of the find, saw three birds, and on June 9, a Mr. Parker saw two birds in the same vicinity.

ENGLISH GAME BIRDS VINDICATED.

Recent investigations of the food of the English pheasant, the red grouse and the partridge of England show that these splendid game birds do not appreciably damage growing crops.* The stomach examination of 183 stomachs of pheasants show that their food consists largely of injurious insects and weeds. This conclusion is of particular interest when it is known that the Board of Agriculture and Fisheries on February 8, 1917, authorized the War Agricultural Executive Committee of each county to reduce the stock of pheasants on any land "where there is a risk of substantial injury therefrom to crops." The only possible harm occasioned by the pheasant for which there seems to be any reliable evidence is that of tramping down corn, and this is not of frequent occurrence, but happens only where birds are unusually abundant.

The food of the young red grouse is made up largely of insects, while that of the adult is largely browse secured from heather and twenty or thirty other plants. So far as agriculture is concerned, the partridge is a harmless bird. The percentage of cereals consumed is small and restricted to a very short season of the year. This is secured largely in stubblefields.

In conclusion, it is pointed out that blame for crop destruction should be fixed upon

*Collinge, W. E., On the food and feeding habits of British game birds. Reprint from Jour. Land Agents Soc., June, 1917, pp. 1-8.

the right species and that the wood pigeon, rook, certain species of gull and the starling have been proved guilty. If birds of the above character are destroyed wholesale the farmer is being robbed of a species that are beneficial, and the real culprits as well as the injurious insects eaten by the game birds, are left to continue their work of destruction of the country's food supply.

THE GROUND SQUIRRELS OF CALIFORNIA.

Anyone interested in the life history or the control of the ground squirrel should obtain a copy of the November-December number of the Monthly Bulletin of the State Horticultural Commission which is available free of charge. This bulletin contains thoroughly up-to-date and unquestionably authoritative information on the ground squirrels of California and their control, compiled by leading state and federal investigators. In the leading article each of the 18 different varieties of ground squirrels known to inhabit the state are treated, and nine of these are figured in color. It is pointed out that only four of these varieties are of special economic importance.

THE FOOD OF MALLARD DUCKS.

A recent bulletin (No. 720) of the United States Department of Agriculture treats of the food habits of the mallard ducks of the United States. Mr. W. L. McAtee, the author, devotes eight pages to an enumeration of the different kinds of food taken by the mallard, the information being based on the examination of 1725 gizzards. The enormous quantities of seeds taken by the mallard duck is evidenced by two stomachs. One contained about 28,160 seeds of a bulrush, 8700 of a sedge, 35,840 of primrose willow, and 2560 duck weeds, a total of more than 75,200. Another stomach contained no fewer than 102,400 seeds of primrose willow besides a number of other items in smaller numbers. "The seeds in this stomach if sowed one in a place and a foot apart each way would suffice for two and one-half acres of ground."

About one-tenth of the food of the mallard is derived from the animal kingdom and nine-tenths from the vegetable. A large proportion of the vegetable food is made up of the seeds of sedges with those of grasses ranking next in importance. About 2.34 per cent of the food of the birds examined was made up of acorns. The animal food consists of mollusks, insects, fishes and crustaceans in order of importance.

Such a detailed report of the food of one of our best game birds is not only valuable in proving the economic status of the bird itself, but should be of help in providing attractive food for wild birds and suitable food for mallards on the game farm.

WILD BIRDS AND LEGISLATION.

Apparently other countries than the United States have suffered from the result of hasty and ill-considered legislation relative to wild birds. In a recent paper by Doctor Collinge, the foremost economic ornithologist of Great Britain, he points out some of the more important statutes passed by Parliament and their ultimate effects upon wild bird life.* The dominant idea throughout early acts of Parliament seems to have been that birds must be reserved and preserved for the king and his retinue, or such favored individuals to whom he pleased to grant licenses.

Practically all of the acts are characterized by selfishness and an utter disregard of the interests of agriculture or horticulture. Among the curious acts are one making it a felony, punishable by death, for a person to wrongfully take the eggs of any "falcon, goshawk, or laner, or the birds of any falcon, goshawk, or laner or laneret," and one providing that "any person who shall take or attempt to take any wild bird by means of a hook or other similar instrument shall be guilty of an offense."

In the summary Dr. Collinge states that a dispassionate and unprejudiced consideration of the facts leads to the following conclusions:

1. That in the past the question of wild bird protection and destruction has never received really serious consideration. The objects sought in most of the acts of Parliament upon the subject have been largely of a selfish nature and not for the good of the country.

*Wild Birds and Legislation, by Walter E. Collinge. Jour. Land Agents Soc., 1917, pp. 278-285.

2. That the majority of these acts have been ill-considered and often hastily prepared; many of them have been repealed and others frequently amended or modified.

3. That no attempt has been made by those who advocate the protection of wild birds, to understand the problem presented by wild bird life. Blindly, and often strongly prejudiced, they advocate protection for all birds, and protection only.

4. That such an attitude is calling forth a deep resentment from those who have to live by the products of the soil, many of whom having waited in vain for repressive measures, *have now taken to destroying wholesale all bird life.*

5. *That the irresponsible advocacy of uniform protection is indirectly contributing more than anything else to the wanton destruction of many of our most useful birds.* "Some of the very greatest friends that our nation has are being destroyed without mercy * * * a defensive force upon which most of our prosperity depends."

6. That the immediate need of the present is for a wide and comprehensive act that will give protection to all non-injurous or beneficial birds, and provide adequate repressive measures for those species which have become too numerous and destructive.

The same condition seems to exist almost everywhere. Realization of the chaotic condition of the game laws due to hasty, ill-considered and constantly changing legislation is not lacking, but the initiative to clean things up and to base game legislation on scientific fact rather than on selfish motive rarely exists.

H. C. Bryant.

FLY LARVAE SUCK BLOOD OF NESTLING BIRDS.

A recent publication of the University of California points out that the nestlings of many of our common song-birds are infested with the larvæ of a fly which sucks the blood.* The fly which is responsible is very much like the common housefly, but is of a metallic blue color. This fly lays its eggs in a newly-occupied nest, and soon the larvae which hatch from the eggs attach themselves to the young birds. Deserted nests usually contain the pupae. Among the common birds whose nests and nestlings were found infested were: the Nuttall sparrow, California purple finch, California linnet, green-backed goldfinch, willow goldfinch, and the California brown towhee. The author of the paper concludes that from 5 to 10 per cent of the parasitized nestlings die from loss of blood.

This discovery doubtless helps to explain the mortality among nestling birds so often noted in the bay region.

*Plath, O. E., A muscid larva of the San Francisco Bay region which sucks the blood of nestling birds. Univ. of Calif. Publ. Zool., 19, 191-200.

IMPORTATION OF QUAIL FROM MEXICO.

The joint regulations governing the importation of quail from Mexico, issued by the Treasury Department and the Department of Agriculture under date of November 13, 1916, were in full force and effect the past season, the entry of quail being permitted from February 15 to April 10, inclusive, and on March 8, 1918, Laredo, Texas, was designated as a port of entry in addition to Eagle Pass, Texas, and New York City. Co-operation was continued with the Bureau of Animal Industry in having a thorough inspection of the birds made during the ten days' quarantine.

The first permit was issued February 20, 1918, and the last, April 4. The number of quail for which permits were issued was 10,500, and the number released from quarantine only 5,205, as compared with permits issued for 42,973, and the release of 32,814 in 1917.

The notably large decrease in the number of quail actually imported during the past year is accounted for by the scarcity of birds in northern Mexico due to drought, and the refusal of large ranch owners to permit the trapping of quail on property owned and controlled by them. Also it is evident that state game officials were reluctant the past year to purchase Mexican quail for propagation because of the severe losses of birds imported during the season of 1917.

Of the 5,205 birds actually released from quarantine only 16 were found dead during the ten days quarantine period, and no case of quail disease was discovered. So far as reports received by the department indicate, there were few losses of birds in shipping. The change of dates

for the importation of Mexican quail—beginning at a later period, February 15, instead of in the fall, as in 1916—has proved beneficial by preventing the birds from reaching the northern states during severe winter weather.—Report of Chief of Bureau of Biological Survey, 1918, p. 17.

FEDERAL MIGRATORY BIRD LAW.

Owing to the prevention of spring shooting during the last few years, under the federal migratory bird law, a great increase in migratory wild fowl has been reported practically throughout the entire United States. The reports state that more birds were killed during the fall of 1917 than in any similar season for many years. With the need of increasing food resources, this increase in game birds, as a result of a federal conservation law, was a practical and opportune return. Continued protection of our wild fowl during the spring will unquestionably continue to increase the returns in food and sport from this source each year.

For administrative purposes under the migratory bird law the United States is divided into 13 districts, under the supervision of 12 inspectors, who, with the assistance of 182 federal wardens, enforce the regulations, in the various states. During the year the commissions of 47 federal wardens were terminated and 49 new wardens were appointed.

The inspectors and federal wardens reported 313 violations of the regulations, which with those of previous years make a total of 1,132 cases on file. All but 29 of these cases, which have been disposed of in court, have been withheld pending the decision of the United States Supreme Court in the case of the *United States* v. *Shauver*, involving the constitutionality of the law. Defects in the law, particularly in that it did not make the possession of birds during the closed season unlawful, and did not confer on inspectors and wardens the power of arrest and search, made it possible for many violators to escape. A further difficulty in enforcement was encountered in the limited number of inspectors, each with an unduly large district. Reports, however, show that violations were more sporadic and fewer birds were killed unlawfully than in previous years.

Voluminous information has been received from state game commissions and others showing that there is an ever-increasing number of waterfowl and shorebirds in most of the states; furthermore, that wild fowl have become unusually tame in spring because they are not molested at that season; and that many thousands are breeding in localities where they had not nested for many years.

The consensus of opinion attributes these greatly improved conditions to the general observance of the federal prohibition against spring shooting which has been brought about through the good will of sportsmen and by the increased activities of this bureau, with closer co-operation of state game authorities.

The friendly attitude of the state game commissions toward the federal migratory bird law has been shown in many ways, particularly in their initiative whereby the state and federal regulations have been brought into harmony. Twenty-three states now have laws making the open seasons on migratory wild fowl similar to those under the federal regulations. Amendments of the regulations were promulgated October 15, 1917, which assisted in unifying federal and state game laws, thus simplifying their administration.

A bill to give effect to the treaty between the United States and Great Britain for the protection of birds which migrate between this country and Canada passed the Senate July 30, 1917. The Senate bill, with amendments, passed the House June 6, 1918, and was then referred to a conference committee. The conference report was adopted by the House June 28, and by the Senate June 29, and the bill was signed by the President and became effective July 3, 1918. Nation-wide interest was manifested in the passage of this legislation, which was secured through the united efforts of state game commissions, sportsmen, farmers, and others interested in the conservation of wild life. The new law contains many excellent provisions necessary for its effective enforcement, and it will be possible to obtain much more satisfactory results under it than have been possible under the original migratory bird law. Canada has already passed an enabling act and promulgated regulations for enforcing the terms of the treaty.—Report of Chief of Bureau of Biological Survey, 1918, pp. 17–19.

LONG RUN OF A TAGGED SALMON.

The United States Bureau of Fisheries has received from John P. Babcock, of the Fisheries Department of British Columbia, record of the capture in the upper Fraser River of a sockeye salmon bearing on its tail a button that had been inserted in marking experiments carried on by the bureau on Puget Sound.

The fish, dip-netted by an Indian at Soda Creek Canyon, British Columbia, on August 16, 1918, had been taken at Village Point, Lumni Island, Washington, on July 19, 1918. Soda Creek is approximately 400 miles from the mouth of the Fraser River, and Village Point is about 70 miles from the same place. Therefore, assuming that the fish moved by the most direct route, the average rate of travel was nearly 17 miles a day.

NIGHT HERONS GAME IN LOUISIANA.

California was for some time noted as the only state in the Union which permitted the hunting of ibis. Louisiana now holds the distinction of being the only state where the night heron is considered a game bird. According to the 1916-18 Biennial Report of the Department of Conservation of Louisiana, the night heron is often utilized as food and the law provides for an open season from November 1 to February 15 with a bag limit of 15 birds. Both the black-crowned night heron and the yellow-crowned are found in the state, and both are popularly known as "Gros-becs." The young while in immature plumage are particularly sought after by hunters and that is why when served *sautes a l'oignon* it is considered a dish "fit for the gods."

CALIFORNIA TROUT.

What kind of a trout did I catch last summer?

An answer to this and like questions will be found in the July number of CALIFORNIA FISH AND GAME which will be a TROUT NUMBER. The colored plates will make identification of trout easy. Watch for the TROUT NUMBER.

FACTS OF CURRENT INTEREST.

The first case made under the Federal Migratory Bird Treaty Act resulted in the conviction of four violators and a sentence of $100.00 fine or 60 days imprisonment.

The work of the deputies in the duck country has been greatly simplified the past year. Fear of the federal law has resulted in few violations.

Whistling swans were abundant in western Stanislaus and Merced counties during the latter part of the open season, but left about the first of February. Several parties who could not forego the excitement of taking a shot at these beautiful birds were apprehended by deputies, and severely fined.

The Sacramento Orphanage and Farm, the Sacramento County Hospital, and the Registrar of Charities, have recently been the recipients of 631 ducks confiscated by deputies during the open season on waterfowl.

The attempt of market hunters to make shipments of ducks to parties in San Francisco whom the shippers did not know was frustrated by deputies of the commission. The old stunt of shipping under fictitious names is not so easily worked as it once was.

Ring-necked pheasants have become so numerous in Inyo County that residents are demanding an open season.

Large catches of herring have been made this spring and this fish has been selling as low as four cents a pound, retail. Even at this price the demand is not sufficient to prevent tons of herring going to the fertilizer works.

The new hatchery on Fall Creek, a tributary of the Klamath River, has been turned over to the Fish and Game Commission by the California-Oregon Power Company and it is now in full operation.

J. C. Bruce of Wawona, who was recently appointed state mountain lion hunter, killed three of the animals on his first day's hunt in Tuolumne County. Mr. Bruce made his record near South Fork Camp and was assisted by his trained varmint dogs. He will remain in Tuolumne County a month and then go to Shasta County to continue the work.

The salmon catch in 1918 was unusually large, exceeding 12,800,000 pounds.

HATCHERY NOTES.

W. H. SHEBLEY, Editor.

Mount Shasta Hatchery.

Approximately ten million quinnat salmon eggs have been shipped to the Mount Shasta Hatchery from the United States Bureau of Fisheries station on the Sacramento River tributaries and from the Klamath River Station, which was operated this year by the California Fish and Game Commission. The eggs have all been hatched out and the fry will be distributed in the upper reaches of the Sacramento and Klamath rivers as soon as they are of suitable size. A considerable number will be held in the three large salmon-rearing ponds at the hatchery over the summer months, and released after the first fall rains.

Loch Leven and eastern brook trout egg collecting operations at the Mount Shasta Hatchery were very successful this season. There are 1,300,000 eastern brook and 3,000,000 Loch Leven eggs and fry on hand at the station at this date.

The rainbow egg-collecting season is a little late this year, there being only 69,000 eggs of this species on hand at the hatchery on March 1.

Mount Whitney Hatchery.

A supply of eastern brook and Loch Leven trout eggs have been shipped from the Mount Shasta Hatchery to the Mount Whitney Hatchery and the fry resulting will be reared and distributed, together with the other species of trout fry handled at this hatchery this season, in the waters of southern California, Tulare and Kern counties.

Work on the improvement of the grounds at the Mount Whitney Hatchery is progressing nicely, much of the preliminary grading and filling-in work having been completed.

Mount Tallac Hatchery.

Arrangements are being made to open the Mount Tallac Hatchery about the middle of March, and an effort will be made to take the usual number of black-spotted trout eggs this season.

Fort Seward Hatchery.

Quinnat salmon eggs to the number of 1,000,000 have been shipped to the Fort Seward Hatchery, and the fry are being reared for distribution in the Eel River and tributaries, Mad River, and tributaries of Humboldt Bay. The usual number of steelhead trout eggs will be shipped to Fort Seward Hatchery this season for distribution in streams of the north coast counties.

Almanor Hatchery.

Egg collecting operations at the Almanor Hatchery were commenced the middle of February. The run of rainbow trout in that section is late this season, and to date no eggs have been taken.

Domingo Springs Hatchery.

This hatchery will be opened up the middle of March and it is expected that the usual take of rainbow trout eggs will be obtained from this station.

Snow Mountain Hatchery.

On February 1 a crew was sent to open up the Snow Mountain Egg-collecting Station and Ukiah Hatchery. Practically all the eggs taken this season at Snow Mountain will be transported by auto truck to Ukiah and "eyed" at that station, as there are better facilities for handling the work at the latter place.

Bear Lake Hatchery.

Arrangements are being made to open up the Bear Lake Hatchery during the fore part of March, and the crew is all ready to proceed as soon as it is possible to get into Big Bear Valley.

Brookdale Hatchery.

Egg-collecting operations were commenced at the Scott Creek Station during the fore part of February, and while the run is a little late, as in other sections of the state, nearly a half million steelhead trout eggs have been taken to date. They are being immediately transported to the Brookdale Hatchery, where they are being "eyed." The usual number of trout fry will be hatched at Brookdale Hatchery for distribution in the streams of Santa Cruz and Santa Clara counties. An additional supply of trout fry will be retained at the Brookdale Hatchery and held in the rearing ponds for distribution during the late summer months in the streams of San Mateo and Marin counties.

Fall Creek Hatchery.

Fall Creek Hatchery, which was constructed by the California-Oregon Power Company, and turned over to the California Fish and Game Commission in lieu of the construction of a fish ladder over the Copco Dam, is in active operation at the present time.

Egg-collecting operations at the auxiliary stations located on Bogus Creek and Camp Creek were commenced during the middle of February, and to date a total of 600,000 eggs have been taken.

A little over a million quinnat salmon eggs were shipped to the Fall Creek Hatchery from the Mount Shasta Hatchery, and the fry resulting from this shipment will be reared and planted in the Klamath River as soon as they have reached the proper age.

Yosemite Experimental Hatchery.

Troughs and fishcultural paraphernalia have been constructed for the Yosemite Experimental Hatchery and plans made to operate early this spring to determine the suitability of the water for hatchery purposes on a large scale in the Yosemite Valley.

Fish Distribution.

In preparation for the season's fish distribution work, Fish Distribution Car No. 01 has been placed in the car shops at Sacramento for extensive repairs. Arrangements are being made for a very early distribution of trout fry this season.

COMMERCIAL FISHERY NOTES.

N. B. SCOFIELD, Editor.

Biological Stations Want Protection.

Much of our dependable information regarding marine life comes as the result of carefully planned experiments at the various biological stations along the coast. Oftentimes marine plants or animals are taken from their native habitat and planted near the station where they can be watched and studied. Valuable experiments which have been started have sometimes been made worthless because of the removal of specimens by thoughtless people. To avoid recurrences of this kind the various stations are asking for a law prohibiting the catching or removing of marine plants or animals within one mile of any marine biological station. In view of the facts as stated above such a law seems reasonable.

Fig. 35. Unloading sardines at Monterey, California. Photograph by Carriel.

Proposed Change of Shrimp Law Would Menace Fish Life.

Attempts are again being made to modify the present shrimp law to allow shrimp fishing in the northern part of San Francisco Bay. Shrimp fishing is now limited to the south bay in order to prevent the destruction of valuable food fish. In order that the Fish and Game Commission might be in possession of facts to oppose the change several hauls of a shrimp net have been made near McNear's Point. Many young striped bass and other young fishes were taken in the hauls and these will be preserved in the form of evidence.

Launch "Albacore" Attempts to Aid Fishermen.

Canneries at San Diego, although well supplied with large sardines, have been short of small-sized ones, which are in great demand. The Fish and Game Commission launch "Albacore" recently spent some time attempting to locate schools of small sardines. The launch had little better success than the regular fishing boats. Where the small fish are located is still a mystery.

New Cannery Established at Ensenada.

The Mexican Industrial Development Company is building a new cannery at Ensenada, Mexico. This company plans to can albacore, crawfish, turtle, and tuna. They will also ship fresh fish to San Diego.

Japanese Trawler in Nets of Law.

One of the first arrests for dragging trawl nets within the three-mile limit that has been made since the food administration's rulings lapsed at the first of the year was recently made in southern California by Deputy H. B. Nidever. Although the Japanese crew aboard the fishing boat "California" of San Pedro cut away their net on finding that they were pursued, they were, nevertheless, rounded up. After a three and a half hour search the specially-designed salvaging gear of the launch recovered the abandoned trawl net. Evidence of the destructive feature of the trawl net was apparent in the large number of fish of many different varieties found in the net. It is because of the large hauls possible with such a net that its use is prohibited in shallow waters.

NOTES FROM THE LONG BEACH LABORATORY.

By WILL F. THOMPSON and ELMER HIGGINS.

Among the rare fish which have come into the laboratory and have not been recorded in "California Fish and Game," is a specimen of what we may term "square-tail" for lack of a common name. It is scientifically known as *Tetragonurus cuvieri* Risso. The individual is mounted, fourteen and a half inches long, and somewhat badly preserved because of frequent handling. The exact locality can not be discovered, the fisherman who owns the fish having forgotten it, but it was near Catalina. This is the first record of the species in the North Pacific. It was taken two years ago or more.

It is characterized by two sharp ridges on each side of the tail, which is deeply forked. These ridges are formed by the hard, rough scales, and appear capable of giving a severe injury. The scales over the whole body are very hard, with fine striations on them, and seem to be fastened together in oblique rows running across the body, so that one might be able to tear them off in strips. The mouth is small, and the fins feeble in appearance, while the teeth show plainly that the species is not capable of attacking large prey, for they are small and comb-like although numerous.

Although there are very early records of its presence in the Mediterranean, yet it is even there a very rare fish. It was probably known as early as 1554, for Rondelet, a writer of one of the very earliest natural histories, published a crude figure, calling it *Mugil niger*, which may well have been this species. Aldrovandi, a later writer, called it *Corvus niloticus*. Willoughby, in 1686, also described it. But the first author giving a description of what is without doubt this fish was Risso, in 1810. Since the time of Risso, the fish has been taken several times in the Mediterranean and near the Madeira Islands. Other specimens have been taken near Woods Hole, Massachusetts, and one has been taken in Aus-

tralia. The specimen here mentioned is the first from our coast line, indeed the first from the North Pacific. We have also a number of specimens which are very small, up to an inch and a half in length, which we have taken in the small meshed nets used by the boat "Albacore," and which are very probably this species. If so, the species must be very abundant instead of very rare, and its rarity must be ascribed to the fact that the fishermen do not take it with any of their gear.

It is said, by the European writers who have chronicled its appearance, that it is at times very poisonous. It is thought to feed on jellyfish and such animals, and to approach the coast in the fall in order to spawn. When it is taken it is usually very inactive and feeble in its movements, probably because it is far from its own native habitat, which is thought to be the very deep sea.—W. F.T.

During the work of the "Albacore" there have been taken several very odd forms of fish. Notable among them is a fish with stalked eyes. It seems to be the same species as one which has been taken in the Indian Ocean, and which has been called *Stylophthalmus paradoxus*. The eye stalks are very long, being one and a quarter times the length of the head. The eyes are set on the end of these long slender stalks, and give a very peculiar appearance to the fish. One must be at a loss to know the use to which such eyes could be put. The fish itself is but two and a half inches long and as transparent as a jellyfish, with black dots along the whole of its very slender and delicate body.—W. F. T.

The fish known as the "King of the Salmon" in textbooks dealing with fish, a member of the genus *Trachypterus*, is supposedly very rare. But in the explorations of the "Albacore" numerous young have been taken. It would seem that it is another of those fish which are not taken by the fishermen, and an instance in which it is obvious that the common belief that a fish is rare because the fishermen do not take it, is wrong.

It is undoubtedly true that it is not possible to obtain accurate samples of the life in the ocean, either by commercial or scientific fishing, when the adult fishes are concerned. There are assuredly species which are never taken by any form of gear save when they are disabled or when they accidentally leave their habitats. It must be just as true that species which are abundant at times are capable of hiding themselves or avoiding the available apparatus used for fishing so completely as to give the impression that the species has left the region. The accidental discovery of such cases should render us very cautious in our conclusions regarding the relative abundance of a species in a region, or the migrations which they undertake.—W. F. T.

A species of sanddab hitherto supposed to be confined to Mexican waters has been taken by the "Albacore" in considerable numbers a few miles south of Oceanside and also by fishermen in the region of San Diego. This species, *Citharichthys xanthostigma*, rather closely resembles the sand dab of the San Francisco markets, but is a wider, plumper fish, equal if not superior in quality to its northern relative. It may prove very important commercially.—E. H. .

Another interesting specimen taken by the "Albacore" in one of her scientific collecting trips is that of a flying fish, new to these waters. The specimen, of the species *Exonautes rondeletii*, was taken some 150 miles off San Diego; and although the species is of wide range in tropical seas, it has heretofore been recorded on this coast only from Acapulco, Mexico, 1700 miles to the south.

Southern California is supposed to yield but one species of flying fish—the one so well known to the sportsmen-anglers of Catalina Island; and whether the new fish is a permanent resident hitherto undistinguished from the common species, which it closely resembles, or another visitant from the south is still a doubtful question.—E. H.

During February the "Albacore" landed Mr. Horace Linton on San Nicholas, a bleak and desolate island off the southern California coast, for the purpose of making some investigations on the abalone. Mr. Linton is a man over sixty years old,

but he intends to live on the island alone for three months and carry on his observations. He expects to look for abalones which he marked and "planted" there six years ago and also to mark many more. He believes that the supply can be increased by intelligent thinning out and transplanting, but whether or not he succeeds in raising the supply to an extent which will be of commercial value, his observations may throw some light on the habits of this most desirable mollusk.

E. H.

The noting of unusual species in southern California seems to have impressed many people with the opinion that the year 1918 has been a very unusual year. It is very probable that it is such a year, but it is here desired to call attention to the fact that this is the first year during which the Long Beach laboratory of the Fish and Game Commission has been actively watching for unusual species, and that aside from the observations which have been contributed to "California Fish and Game" from it, there have been very few rare species noted, from that vicinity. The popular saying in southern California that "every year is an unusual year in California" comes to mind in this connection, and one must of necessity be very cautious in concluding that last year was any more unusual than the preceding years have been.—W. F. T.

During the past four months the "Albacore" has had the opportunity to take several trips for scientific purposes. On November 26 and 27 one was made to Catalina Island and return to haul for young fish and eggs; November 30 to December 7, a trip was made to Point Concepcion and return to obtain flatfish by bottom trawling; December 8 to 10, the trip to Catalina Island was repeated; December 11 to 14, the coast from San Pedro to San Diego was prospected for flatfish; February 3, 4 and 5, a trip was made to San Nicholas Island with Mr. Linton, to haul also for young fish and eggs over deep water; and February 6 and 7 were consumed in a trip to Newport to do bottom trawling in the bay. The next trip for scientific purposes should begin about the first of March. These trips have been very largely for the purpose of exploration, and beginning with the March trip, it is hoped to take regular trips over a definite route, in order to follow the development and drift of the pelagic young and the eggs, and to observe carefully three chosen flatfish grounds.

The work in the laboratory has been along lines followed for some time past. The correlation between the temperature, or weather, and the catch of albacore has been carefully analyzed for the year 1915, and a very high degree found. It will be remembered that some work has also been published for the year 1916—for instance in the Pacific Fisherman for June, 1918, and in a previous number of "California Fish and Game." The data for 1917 is now undergoing a similar analysis. The work on the natural history of the albacore is also steadily progressing along other lines, but until the observations to be made this summer are complete, it is not likely that a final report will be made. A preliminary report on several subjects will probably be made soon. In regard to the sardine it may be mentioned that examinations have been made of the state of maturity at various times, and the progress observed to be the same as was carefully followed last year.

Our thanks are due the Zoology Department of Stanford University for the privilege of using the library and collection of fishes belonging to that institution, and more particularly to Dr. C. H. Gilbert for his personal advice and assistance to Mr. Higgins during his recent visit there.

CONSERVATION IN OTHER STATES.

WARDENS DO DETECTIVE WORK IN NEW YORK.

The New York Conservation Commission has been detailing game protectors upon secret service work in the Adirondacks. They operate under concealed identity, in the manner of detectives, in every branch of police activity. The work that they did and the results accomplished are believed to be more extensive than in any similar task ever before undertaken in the cause of game protection. The reports turned in by these men gave the Conservation Commission the necessary knowledge and power, for the first time in the history of game protection in New York State, to deal adequately with the condition of lawlessness in the deer forests.

ILLINOIS SPORTSMEN DISSATISFIED.

The *Illinois Sportsman*, the official organ of the Illinois Sportmen's League, continues to rap the migratory bird law and accuse the Biological Survey of unfair treatment to the sportsmen of the Middle West. According to a recent number of the paper the lack of ducks during the past open season is due to the working of the present federal law which does not allow early spring shooting, but does allow, according to this paper, the slaughter of a large number of birds in Texas and in other states. The paper also tries to point out that the dismissal of the appeal to the United States Supreme Court for a decision on the constitutionality of the former migratory bird law leaves the Shauver case the supreme law of the land, and questions the immunity of the treaty over review in the courts. It will be remembered that in the case of the *United States* vs. *Shauver*, Judge Trieber held that migratory game when in the confines of a state belongs to the state and not to the public of the United States.

If the sportsmen of the Middle West are actually receiving unfair treatment, it is high time that their case is investigated; but if, on the other hand, they are working selfishly for their own profit and overlooking the general welfare, agitation of this sort should be frowned upon by every one interested in wild life. We are glad that California has so loyally defended the new law which apparently is doing wonders for the preservation of our waterfowl.

WASHINGTON COMMISSION MAINTAINS PERMANENT EXHIBIT.

The Washington Fish and Game Commission maintains a permanent exhibit in the city of Seattle. Aquaria containing many varieties of fish, models of fish ladders, fish screens, preserved specimens of many varieties of fish and shellfish, and an exhibit of fish products form the larger part of the exhibit. Some mounted elk and game birds display the game resources of the state. The offices of the commission are in the same building, and the hundreds of visitors find it easy to have their questions answered.

WASHINGTON WILL OPEN THE SEASON ON ELK.

Of the seven or eight thousand elk on the Olympic Peninsula in the state of Washington, nearly 50 per cent are bulls. In order to reduce this number an open season during the month of November has been recommended to the legislature. Nonresident hunters will be required to hire licensed guides at $5.00 a day, and the license fee will be $25.00 or $50.00. In order that only a limited kill may be made only one animal will be allowed each individual and all the meat must be utilized.

VERMONT PLANS QUARTERLY BULLETIN.

According to their last biennial report the Department of Fisheries and Game of Vermont advocates the publication of a semiannual or quarterly bulletin for circulation among the members of sportsmen's leagues, and others interested throughout the state. This bulletin should give items of interest from the work of the department, and from the wider field of interstate and international activities, in this way moulding and directing public sentiment along the most progressive lines.

Vermont in starting such a bulletin will be following the lead of California and other states which several years ago became convinced of the desirability of such a means of publicity and education.

LIFE HISTORY NOTES.

ELK IN SHASTA COUNTY.

John M. Punnett, a civil engineer of San Francisco, who has recently returned from the Pit River, Shasta County, where he has been in camp with a survey party, reports that in the latter part of November, 1918, a small herd of elk were seen on the mountain side on the north bank of the Pit River. They were observed by all the members of the party consisting of five men. Owing to the speed at which the herd was traveling, the distance between it and the observers and the steep, wooded, brushy character of the country it was impossible to be absolutely certain of the number of animals, but the concensus of opinion was that the herd consisted of one bull and either four or five cows.

Some cattle men who were driving stock out of that part of the country stated that during the past year or so they had repeatedly seen what was presumably the same herd. There is good evidence that the herd ranges on the southerly slopes of the Brock Mountain, between the summit and the Pit River.—M. Hall McAllister.

DEER HUNTING POOR IN MONO COUNTY.

We have no knowledge of any deer having been killed in Mono County during the 1917 season. The season, as changed by the redistricting of California, gives the residents of this county very little chance to kill a deer during open season. The deer range very high in almost inaccessible localities during the month of September, not working down until the season closes.—W. M. Maule.

DEER INCREASING IN TRINITY GAME REFUGE.

In the ten years that I have been traveling at different times over the southern and western part of the game refuge (1-D) I have never seen so many deer. The numerous deer tracks rather gave the impression of a band of sheep wintering there. Hunters complained last hunting season that, as soon as the shooting commenced, all the deer knew the refuge and ran over the line and stayed there. I believe there is some truth in this, from my own observations, but not so much as they would have the general public believe.—G. O. Laws.

GROUSE IN THE SEQUOIA NATIONAL FOREST.

Sierra grouse are found from the 5,000-foot contour to the 11,000 in the Sequoia National Forest. They nest principally at the lower elevations between May 15 and June 15, laying from 8 to 14 eggs. The average brood hatched is about 10. Until the young are fully feathered they feed on and in the vicinity of small meadows, eating principally grass, seeds, grubs and berries. When the young are able to fly they usually migrate to the higher elevations and live principally in thickets and fir timber. When there they feed principally on berries and fir and pine needles. A peculiar thing about them is that they go to high elevations to winter and evidently live entirely on pine and fir needles.—Frank P. Cunningham.

RIVER OTTER PLAYS ON MOONLIGHT NIGHTS.

Lake Leonard, situated in the mountains of Mendocino County at an elevation of about two thousand feet, is a small natural lake with no visible outlet. The past summer on moonlight nights an animal was frequently heard splashing in this lake. Observation between the hours of 2 and 6 a.m. on December 22 disclosed an animal swimming about and playing in the water like a sea lion, suddenly bobbing up, giving huge splashes, playing about a bit, then disappearing entirely for a time. When most boisterous it uttered a sharp little scream or made a noise that sounded like a long-eared dog shaking itself on coming out of the water. It appeared larger than a large dog, and could swim very rapidly. No slides have been noticed along the shore, but the animal's actions left no doubt that it was a Pacific river otter (*Lutra canadensis pacifica*).—Una Boyle.

VALLEY QUAIL WITH EGG IN DECEMBER.

When cleaning some valley quail secured near Jolon, Monterey County, December 21, 1918, I was surprised to find a female containing a well developed egg. Unfortunately, the egg was broken in cleaning, but its presence is nevertheless a fact, as can be substantiated by others to whom it was shown. The eggshell was of a yellowish color, and was situated in the oviduct just ready to be deposited.—Edward L. Bosqui.

WILD LIFE IN RELATION TO AGRICULTURE.

BLACKBIRDS AND RICE.

Blackbirds are a serious menace to rice culture, particularly as an agency in the distribution of water grass seeds. While blackbirds in large flocks frequently destroy large areas of rice during the maturing period, they also congregate along the sloughs where the indigenous millets are found, the seeds of which mature some weeks in advance of rice, and of which the blackbirds consume large quantities. When blackbirds arise rapidly from a slough it has been observed that they carry with them heads and seeds which are dropped into the fields over which they pass.—W. O. Jacobson.

DUCKS DESTROY GARDEN PESTS.

Theodore Kytka, the famous handwriting expert of San Francisco, has for many years successfully reared wild mallard ducks in his back yard. Finding them of value as destroyers of pests he has recently given a number of the birds to friends in order that they may clean the gardens of snails, slugs, and other garden pests.

PHEASANTS DAMAGE CROPS IN INYO COUNTY.

After much observation and many discussions with ranchers in the Owens Valley I am of the opinion, and would earnestly advocate, that either an open season be allowed for the introduced pheasant, or that it be left unprotected entirely. It is becoming a pest here, and the farmers who raise grain or small fruits welcome this bird about the same as they do the English sparrow and California linnet (two great nuisances). I quote one of the ranger's reports: "The pheasants are increasing rapidly in the valley and live on the farmers' crops in the summer time, doing them considerable damage." One of the fruit growers here showed me a few boxes of grapes which he intended to ship, but the bunches had been thinned considerably owing to damage by birds. He stated that the robin and a small gray bird (probably the linnet) did a lot of damage, and that the pheasant was a very wicked bird, hiding under the bushes and eating his grapes whole. One of the ranchers near town tells me that he has seen small patches of corn entirely destroyed by pheasants, the birds eating out the grain just after the plant has sprouted.—E. L. Herzinger.

MOLE EATS ANGLEWORMS.

The stomach of a mole (*Scapanus latimanus latimanus*) killed on September 23, 1916, at Hayward, California, was filled with angleworms cut into short pieces, one-quarter to one-half inch in length. This evidence, combined with the fact that moles kept in captivity devour large quantities of earthworms, indicates that this animal feeds largely upon worms and insects found beneath the surface of the ground.—W. N. Dirks.

California Fishery Products Compiled by Department of Commercial Fisheries—October, November, December, 1918.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Alameda, Contra Costa	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego	Imperial	Total	Mexico
Albacore								39	5,084		24,982		374		30,479	
Anchovy							5,003		172,788		18,633				196,424	
Barracuda							4,642	7,628	33,476	16,553	292,712		230,949		585,960	410,632
Bonita								180	2,077	2,803	159,866		547,327		712,253	170,018
Bocaccio							2,189	9,968	291,667						303,824	
Bluefish									10,076		185				10,261	
Chilipepper									46,284						46,284	
Carp				1,946	20,691	13,246	2,420								38,303	
Catfish		5,444		3,258	1,519	1,323									11,544	
Croakers											6,987		371		7,358	
Coalfish							150		258		24				432	
Cultus cod	212						41,204	8,763	121,415			457			172,051	
Dolphin											21				21	
Dogfish			3,150			8	68,003	500	4,205		2,960		9,272		88,104	
Flounder			242				43,499	11,883	2,428		1,290		150		59,492	
Halibut	1,183						4,063	4,049	2,798	143,173	146,244	4,210	20,510		326,230	139,234
Hardheads					3,052	9,704									12,756	
Hake							25,819	23,450	1,775		7,205		3,062		64,311	4,247
Herring	2,709		184,992				56,550				190				244,441	
Kingfish							17,264	22,750	4,632	159	243,997	39	1,755		290,596	
Mackerel								353	264,893	217	133,414	1,573	9,833		410,283	11,551
Marlin											261				261	
Mullet														3,582	3,582	1,715
Pike				63	10	2,468									2,541	
Pompano			3				277	66	5,068		2,923				8,337	
Perch	2,676		15,505			90	23,441	4,445	2,147	805	15,876		570		65,556	365
Rock Bass										2,059	181,012	825	18,187		202,083	4,129
Rockfish	926		150				403,850	103,620	84,986	13,442	194,359	8,274	314,292		1,123,899	7,802
Sole							1,006,353	172,414	42,332	30,434	7,700	25	1,745		1,261,003	
Salmon	720,994		1,069	10,978	6,524	12,278	22	15	54						751,934	
Smelt	8,438		4,318			95	11,939	15,983	6,071	8,589	110,440	72,652	12,959		251,484	7,991
Sea bass (white)			10,887				11,641	69,823	11,389	4,030	154,419		10,703		272,892	70
Sea bass (black)									248	961	41,503	248	17,406		60,366	32,588
Sanddabs							172,721	30,777	542		1,472	25			205,537	
Suckers					1,156	260									1,416	

Striped bass			159	46,133	20,989	163,727	1,086							232,094	
Buck shad															
Shad				1,588	1,574	2,765	47							5,974	
Roe shad															
Skip jack								728	155		885,345	133	426	883,787	
Sturgeon															
Sardine							506,400	449,725	22,885,726		8 341,757		785,434	32,969,042	
Skate							45,011				437			45,448	
Surf fish											943			943	
Sculpin									2		9,390			9,392	
Sea trout											4,350	941	12	5,303	
Sheepshead										45	7,129		11,467	18,641	3 0
Sword fish											1,000		580	1,580	
Tom cod							2,943				15,507	60		18,510	
Trout (farm)															
Trout (steelhead)	14,055													14,055	
Tuna									568	165	1,162,611		247,751	1,411,095	
Turbot			2,333											2,333	
Whitebait			692				937		81					1,710	
Yellowtail								10,058	64,712	5,276	2,898,906	1,030	1,378 879	4,358,891	94,188
Miscellaneous							23,097	21	19,858	13,374	39,424	3,175	8,833	110,782	124,903
Totals	751,193	5,444	223,500	63,996	55,515	205,964	2,482,571	950,238	24,087,795	242,083	15,115,480	93,607	3,632,847	3,582	47,914,878	1,009,493
Crustaceans—															
Crab (doz.)	634					13	7,886	7						8,548	
Spiny lobster										15,303	112,970	1,082	21,815	151,173	205,272
Shrimp							150,119							150,119	
Ecrevisse															
Mollusks—															
Squid															
Cuttlefish							137	83	1,611		249			2,080	
Clam (Pismo)								185		73,268				73,453	
Clam (cockle)			4,403								1,595			5,998	
Clam (softshell)		257	28,765			57,055								86,077	
Clam (mixed)	8,086		3,565							1,323	4,197			17,171	
Oyster (native), No.			94,200											94,200	
*Oyster (shell), No.			312,293				2,149,575							2,461,868	
Abalones		135							44,229	56,877	50,730			151,971	
Sea snails											355			355	
Mussels						773	513			3,044	1,859			6,199	
Reptiles															
Terrapin				2										2	

*Eastern.

STATEMENT OF EXPENDITURES—Year 1918.

Item of expense	October	November	December
General administration	$1,628 14	$1,651 12	$1,728 47
Research, publicity and education (game)	219 46	216 00	237 23
Printing		424 20	
Fish exhibits			
Game exhibits			
Game farm	348 20	84 06	
Mountain lion bounties	320 00	210 00	540 00
Lithographing hunting licenses	110 48		
Lithographing angling licenses			950 00
Hunting license commissions	2,806 60	833 90	2,179 10
Angling license commissions	1,115 10	1,328 00	1,583 30
Market fishing license commissions	1 50	77 00	37 50
	$6,549 48	$4,825 28	$7,278 70
San Francisco District	$5,986 92	$5,769 10	$5,769 16
Sacramento District	3,849 58	3,932 43	3,948 54
Los Angeles District	2,404 05	2,289 21	2,354 22
Launch patrol	1,146 58	1,310 64	2,284 38
Prosecutions (fish and game)	42 60	107 75	100 00
Crawfish inspection	248 39	200 00	200 00
Winter game feeding			
Accident and death claims	124 04	155 05	124 04
	$13,802 16	$13,755 18	$14,780 31
Hatchery administration	$878 70	$838 21	$743 96
Mt. Shasta Hatchery	8,531 26	2,844 33	2,340 28
Klamath Station	1,429 37	1,397 50	924 05
Mt. Whitney Hatchery	2,095 37	1,090 77	937 77
Cottonwood Lakes Station			
Tahoe Hatchery	222 47	16 85	5 00
Tallac Hatchery	23 17	5 00	7 04
Ft. Seward Hatchery			142 53
Eel River Station	622 65	456 38	443 07
Ukiah Hatchery	14 30		
Snow Mountain Station			
Brookdale Hatchery	92 40	122 15	241 61
Scott Creek Station	31 00	30 00	31 00
Feather River Hatchery			
Almanor Hatchery		10 00	5 00
Domingo Springs Hatchery	81 84		
Clear Creek Hatchery	458 59	58 93	
Bear Lake Hatchery	208 59	360 50	88 52
North Creek Station		721 90	252 19
Wawona Hatchery			
Yosemite Hatchery		120 55	400 91
Fish distribution			
Fish transportation	3 00	3 00	3 00
Screen, fishway and water pollution	211 13	191 87	249 57
Special field investigation			
	$15,057 74	$8,227 03	$6,845 70
Department Commercial Fisheries	2,663 02	3,140 15	2,735 93
	$38,072 40	$29,948 67	$31,940 67
Department of Engineering			
Launch "Albacore"			
Yosemite Hatchery			

VIOLATIONS OF FISH AND GAME LAWS.

December 1, 1918, to March 1, 1919.

Offense	Number of arrests	Fines imposed
Game.		
Hunting without a license	27	$495 00
Making false statement on application	1	25 00
Deer—close season—killing or possession	11	335 00
Female deer, spike bucks, fawns—killing or possession	5	100 00
Quail—close season—killing or possession		
Excess bag limit	1	25 00
Ducks—close season—killing or possession	2	90 00
Excess bag limit	2	75 00
Shooting ducks from power boat in motion	4	110 00
Cottontail and brush rabbits—close season—killing or possession	1	50 00
Grouse—close season—killing or possession	1	25 00
Rail—close season—killing or possession	1	25 00
Swan—killing or possession	4	75 00
Nongame birds—killing or possession	22	456 00
Shore birds—close season—killing or possession	3	75 00
Night shooting	14	250 00
Trespassing on posted grounds	2	40 00
Trapping without license	2	40 00
Total game violations	103	$2,291 00
Fish.		
Angling without license	5	$95 00
Fishing for profit without license	3	50 00
Clams—undersize	3	75 00
Abalones—close season—undersize, excess limit	34	325 00
Spiny lobsters—close season—taking or possession		
Undersize, oversize	6	140 00
Trout—close season—taking or possession, excess limit	6	180 00
Trout—taking other than by hook and line	3	25 00
Dynamiting fish	1	200 00
Failure to produce license on demand	1	
	62	$1,090 00
Grand total fish and game violations	165	$3,381 00

SEIZURES—FISH AND GAME AND ILLEGALLY USED FISHING APPARATUS.

December 1, 1918, to March 1, 1919.

Game.	
Deer meat	219 pounds
Ducks	476
Shore birds	17
Wild pheasants	2
Miscellaneous game	20
Beaver skins	4
Mink skins	3
Fish.	
Striped bass	58 pounds
Trout	1,825 pounds
Crabs	42
Pismo clams	103
Lobsters	1,311
Abalones	691
Halibut	2,693
Illegal nets	1
Searches.	
Illegal fish and game	9

NUMBER OF DEER KILLED IN VARIOUS COUNTIES DURING THE OPEN SEASON 1917.

District No. 1.

Alpine	12
Amador	59
Butte	---
Calaveras	66
Del Norte	---
El Dorado	60
Fresno	125
Humboldt	36
Inyo	72
Kern	---
Kings	---
Lassen	150
Madera	---
Mariposa	---
Merced	23
Modoc	164
Mono	36
Nevada	130
Placer	34
Plumas	200
Sacramento	51
San Joaquin	---
Shasta	330
Sierra	---
Siskiyou	118
Stanislaus	---
Sutter	---
Tehama	253
Trinity	560
Tulare	300
Tuolumne	250
Yuba	---
Total	3,012

District No. 2.

Colusa	150
Glenn	221
Lake	423
Marin	162
Mendocino	140
Solano	140
Sonoma	---
Yolo	---
Napa	116
Total	1,352

District No. 3.

Alameda	---
Contra Costa	---
Monterey	155
San Benito	121
San Francisco	---
San Luis Obispo	342
San Mateo	150
Santa Clara	300
Santa Cruz	69
Total	1,137

District No. 4.

Imperial	---
Los Angeles	208
Orange	---
Riverside	52
San Diego	30
San Bernardino	95
Santa Barbara	425
Ventura	438
Total	1,248
Miscellaneous	105
Total for year 1917	6,854

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A. HOEN & CO., LITH.

GOLDEN TROUT OF VOLCANO CREEK, SALMO ROOSEVELTI EVERMANN

(DRAWN FROM LIFE BY CHARLES B. HUDSON FROM THE TYPE, A SPECIMEN 11⅛ INCHES LONG.)

CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

Volume 5 SACRAMENTO, JULY, 1919 Number 3

CONTENTS.

		Page
THE GOLDEN TROUT (colored plate)	Frontispiece	
CALIFORNIA TROUT	*B. W. Evermann and H. C. Bryant*	105
THE STEELHEAD TROUT (colored plate)	Facing page	112
THE RAINBOW TROUT (colored plate)	Facing page	114
THE EASTERN BROOK TROUT (colored plate)	Facing page	130
SUMMER ON THE CALIFORNIA TROUT STREAMS	*Robert Page Lincoln*	136
PARASITES WHICH AFFECT THE FOOD VALUE OF RABBITS	*E. Ralph De Ong*	142
OUT FISHIN' (a poem)	*Edward A. Guest*	144
EDITORIALS		145
FACTS OF CURRENT INTEREST		150
HATCHERY NOTES		151
COMMERCIAL FISHERY NOTES		154
Notes from the State Fisheries Laboratory		156
CONSERVATION IN OTHER STATES		159
LIFE HISTORY NOTES		160
REPORTS—		
Canned, Cured and Manufactured Fishery Products, 1918		162
Fishery products, 1918		164
California Fishery Products—January, February and March, 1919		166

CALIFORNIA TROUT.*

By BARTON WARREN EVERMANN and HAROLD C. BRYANT.

INTRODUCTION.

The trout of whatever kind all belong to the Salmonidæ or salmon family. Besides the true trout, this family contains also the salmons, the charrs, the whitefish, the lake herrings, and that curious fish of the far north, the inconnu. The Salmonidæ are confined to the northern hemisphere and chiefly north of the fortieth parallel where they are nearly everywhere abundant wherever suitable waters are found. Some of the species, especially the larger ones, are marine and anadromous, living and growing in the sea, and entering fresh waters only for spawning purposes; still others live in running brooks, entering lakes or the sea as occasion serves, but not habitually doing so; still

*Although containing some new information, this paper is largely a compilation of material from published sources.

others are lake fishes, approaching the shores or entering brooks in the spawning season, at other times retiring to waters of considerable depths. Some species are active, voracious, and gamey, while others are comparatively defenseless and rarely or never take the hook.

Of all the families of fishes there is none more interesting than the Salmonidæ, from whatever point of view they may be considered. To the biologist the family is of surpassing interest because of the remarkable life histories and habits of many of the species; to the angler, what fish has appealed more strongly than salmon and trout because of their game qualities and their beauty? to the epicure, there is none more delicious or more persistently sought; to the lover of the beautiful as exhibited in animate forms, what appeals more strongly than the silvery sheen, roseate or golden hues, and the beautiful form of the salmon, the brook trout or the golden trout; to the fish culturist, the Salmonidæ are of the greatest interest and importance, more species of this family being propagated artificially than of all other species combined; and to the commercial fisherman, this family of fishes is the most important in all the world.

The true trout all belong to the genus *Salmo* and are found only in the northern parts of Asia, Europe and North America; in Europe they extend as far south as the Pyrenees, and in America to Lower California and Durango and eastward as far as the Black Hills and Colorado.

The name "trout," a word of French origin, is in Europe applied only to species with black spots, while in America it is more loosely used and is applied not only to the true trout (those with black spots), but also to the charrs (or those with red or orange spots). In western North America are many species of true trout, some of them differing widely in size and color, while others resemble each other so closely as to make positive identification difficult. The Salmonidæ are of comparatively recent origin, none of the species occurring as fossils except in recent deposits, and this doubtless accounts for the instability of their specific characters.

How to Distinguish Trout from Salmon.

Trout.	Salmon.
1. Most species remain in fresh water, never going to sea; do not die after once spawning.	1. Live habitually in the sea, entering fresh water only at spawning time; spawn once then die.
2. Skeleton hard.	2. Skeleton porous and soft.
3. Anal fin with 12 or fewer rays.	3. Anal fin with 13 to 20 rays.
4. Gillrakers, 20 or fewer.	4. Gillrakers, 20 to 40.
5. Pyloric cæca few, 40 to 65.	5. Pyloric cæca numerous, 75 to 180.
6. Branchiostegals, 10 to 12.	6. Branchiostegals, 13 to 19
7. Caudal peduncle deep.	7. Caudal peduncle constricted.

The commercial fisherman distinguishes between salmon and trout by noting whether the fish is easily held up by the tail. The constricted portion in front of the tail (caudal peduncle) makes it easy to hold a salmon by the tail, but that of a trout is so nearly the size of the tail fin that it is held up with difficulty.

The native trout of western North America may be regarded as falling naturally into three more or less well-defined series, which are popularly

known as the Cutthroat Series, the Steelhead Series, and the Rainbow Series.

The species of the Cutthroat Series are characterized by small scales, 150 to 200 in a cross-series, a large deep-red or scarlet dash on each side of the throat, a large mouth, the maxillary more than half length of head, and small hyoid teeth. The most useful diagnostic character is the red dash or mark on each side of the throat between the dentary bones of the lower jaw. This mark is nearly always present and is usually quite distinct.

There are many species of the Cutthroat Series. They inhabit the streams and lakes from Humboldt County, California, northward to southeast Alaska and eastward through all of the northwestern states to the headwaters of the Missouri, the Platte, the Arkansas and the Rio Grande. At least one species is found in the headwaters of the Colorado. They are particularly abundant in the coastal streams and lakes of Oregon and Washington. In California, they appear to be confined chiefly to the northwest counties and are nowhere abundant.

In the Steelhead Series the scales are somewhat larger, the number in a cross-series being usually about 150, but varying from 130 to 180. There is no red dash on the lower jaw; the body is rather stout, mouth moderate, the maxillary about half length of head, hyoid teeth wanting. Color silvery. Size large. Sea-run species.

In California, the steelhead is limited to coastwise streams and is anadromous. To the northward, it extends further inland, ascending the Columbia and its tributaries to Shoshone Falls in Snake River and to the headwaters of Salmon River in Idaho. To the northward it is found as far as Kodiak Island. In certain lakes of Washington and British Columbia are found several local forms which have been described as distinct species.

In the Rainbow Series the scales are typically still larger (except in the golden trouts), the number in a cross-series being normally 130, but varying from 115 to 180; usually no red on the throat; a red or rosy lateral band; body stout; mouth small, the maxillary short, 2 to 2.5 in head; no hyoid teeth. Size small.

The rainbow forms are chiefly confined to the streams of California and Oregon. The typical rainbow (*Salmo irideus*) was originally described by Dr. William P. Gibbons of San Francisco in the Proceedings of the California Academy of Sciences for 1855, from specimens obtained in San Leandro Creek, Alameda County. The rainbow occurs less abundantly in Oregon and Washington and as far north as Naha Stream and Klawak River, Alaska.

Besides these three series of true trouts, we have the charrs of the genera *Salvelinus* and *Cristivomer*. The "Dolly Varden" is the only native charr in California. The introduced Eastern brook trout is a near relative, and is, like it, a charr. The charrs are separated from the true trout by the presence of red or orange-colored spots on the sides. The word "charr" means "red" or "blood," and since members of the genus *Salvelinus* are usually marked with red spots or are red beneath, the group is well named.

In addition to the native trout, there are several species which have been introduced into California streams from Europe. Chief among these are the brown trout from central Europe and the Loch Leven trout from Scotland.

Cutthroat Series.

The native lake trout in the larger lakes of the Sierras and one of the stream trouts of northern and northwestern California are cutthroats. The species now recognized are:

Cutthroat Trout (*Salmo clarkii*), in Pit River, Eel River and other streams in Humboldt and Del Norte counties.

Tahoe Trout (*Salmo henshawi*), in Lake Tahoe, Donner, Webber, and Independence lakes and tributary streams. Included under this name are several trout which have been described as distinct species.

Royal Silver Trout (*Salmo regalis*), in Lake Tahoe.

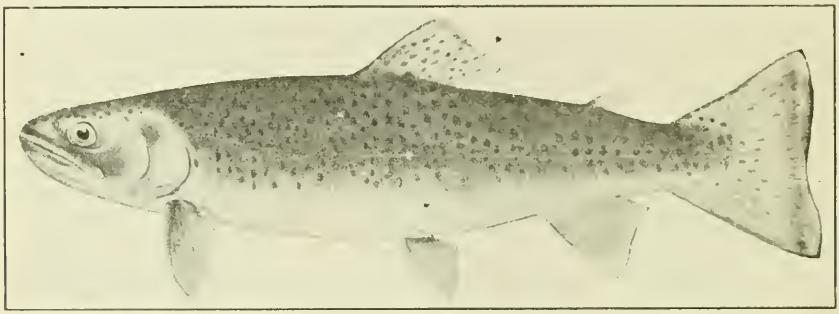

Fig. 36. Cutthroat trout (*Salmo clarkii*).

Charrs.

The Dolly Varden (*Salvelinus parkei*) is the only charr native to California streams. Its distribution in this state is limited to the McCloud River. The introduced Eastern brook trout (*Salvelinus fontinalis*) and the Mackinaw Trout (*Cristivomer namaycush*) are the only other charrs found here.

Rainbow Series.

Most of the native trout found in California belong to this series. The following eight species are here recognized as belonging to the Rainbow Series.

Shasta Rainbow (*Salmo shasta*), in the upper Sacramento and McCloud rivers.

Noshee or **Stone Trout** (*Salmo stonei*), in the McCloud River.

Gilbert Rainbow (*Salmo gilberti*), in the Kings and Kern rivers.

South Fork of Kern Golden Trout (*Salmo agua-bonita*), native only to the South Fork of the Kern, and from Cottonwood Creek and the Cottonwood Lakes into which it has been introduced.

Golden Trout or **Roosevelt Trout** (*Salmo roosevelti*), native only to Volcano Creek.

Soda Creek or **Little Kern Trout** (*Salmo whitei*), native to the Little Kern and other western tributaries of Kern River.

San Gorgonio Trout (*Salmo evermanni*), known only from the streams about San Gorgonio Peak, southern California.

Nelson Trout (*Salmo nelsoni*), known only from the San Pedro Martir Mountains of Lower California.

There is a trout, apparently of the Rainbow Series, in the Klamath River which fish culturists believe to be different from any of the above, which has not yet been described. There is still another in Burney Creek, Shasta County, which also remains to be described.

Introduced Trout.

As a result of hatchery operations the following non-native trouts are to be found in California streams:

Brown Trout (*Salmo fario*), a native of central Europe.

Loch Leven Trout (*Salmo trutta levenensis*), a native of Scotland.

Eastern Brook Trout (*Salvelinus fontinalis*), a native of the Atlantic Coast streams.

Mackinaw Trout (*Cristovomer namaycush*), a native of the larger lakes of the northeastern United States and Canada.

Size and Coloration.

Size seems to depend upon food supply and extent of water. Residents of small mountain streams and pools seldom attain the size of individuals inhabiting lakes or rivers where there is an abundant food supply.

Water appears to have some influence on the coloration of trout. Brackish or salt water usually gives them a silvery color with few or no spots. Possibly the substrata constitute the factor most involved in coloration. Profusely spotted trout are generally found in clear rapid rivers or alpine pools; in large lakes with a peaty bottom, fish often assume an almost uniform blackish coloration.

Sexual differences are not always apparent in trout except in the breeding season, at which time the female is usually a deeper, heavier fish and the male a more slender one. However, the male is sometimes the brighter in color.

Young trout are all similarly barred with the parr-marks and are difficult to identify.

Trout Angling.

The usual style of fly fishing consists in wading the stream and making casts downstream in likely places—at the foot of riffles, at the edges of stumps, logs and brush, and beneath overhanging bushes and banks. On the contrary, the more refined, dry-fly angler casts upstream, presenting his fly in such a manner that it will float over a rising fish. In order to have the flies float, they must be dry. They are oiled before using, and false casts are made between real casts to remove the surplus moisture.

Some fishermen drag the flies over the water at the end of each cast, believing that the motion resembles that of an insect endeavoring

to escape from the water. Sometimes flies are tied with head toward the hook-barb so that, on being drawn over the water, the resistance of their legs and wings will cause them to flutter as if alive.

The dry-fly angler declares that the more attractive method is to allow the flies to float quietly, and to enable them to remain on the surface. Usually local dealers can supply the best information on the proper flies to use.

When streams are high, better results are obtained by the use of baits such as prepared salmon eggs or grasshoppers, earthworms and helgramites. In clearer water spinners may also be used with good effect.

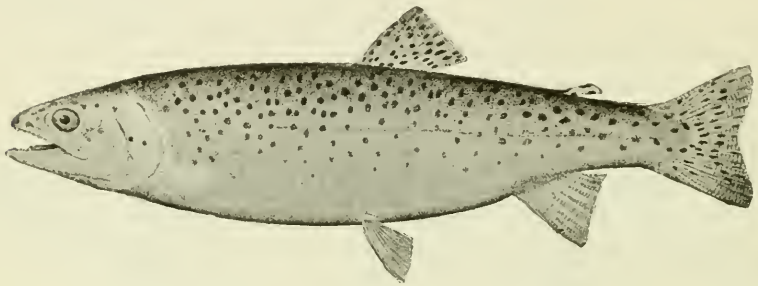

Fig. 37. Tahoe trout (*Salmo henshawi*).

Trolling is the method usually employed by fishermen and anglers in catching trout in the larger lakes. Similar equipment is used by anglers in taking the so-called steelhead at river mouths. But these methods are not practiced by the accomplished angler.

"Along the lower courses of the rivers and on the lakes, especially off rocky points where the rapidly shelving bottom brings the deep water near shore, a crude method of bait casting is successfully employed in taking large trout. The large trout seldom rise to the artificial fly except at times in the high Sierras. The same species when living in the rivers and in their rapid and cool tributaries furnish excellent sport for the angler. All recommend small flies, 12 to 16, and not in great variety. Many of the smaller streams are so closely lined with dense brush as to make fly fishing quite out of the question. Here the angler should provide himself with a short bait rod, use worms and grasshoppers."—*Snyder.*

As has been pointed out in many an article, the prime rules of fly fishing are:

1. Fish in streams where trout are found. Those streams not easily accessible are always best, for they are not depleted.

2. Move cautiously and noiselessly in order not to frighten the fish.

3. Drop the fly on the water "as if it hated to get wet" or, in other words, simulate the natural dropping of an insect on the water.

KEY TO CALIFORNIA SPECIES OF TROUT.

a. Species anadromous, entering coastal streams for spawning purposes; color silvery;

aa. Species not anadromous; size smaller.
size large---------- **Steelhead** (Salmo gairdneri). Page 112

b. Scales typically large (except in the Golden trouts), about 130 in a cross-series (varying from 120 to 180); little or no red on throat; usually a rosy or yellowish lateral band; mouth small, maxillary 2 to 2.5 in head; no hyoid teeth; size small.

c. No extensive lemon yellow on sides below lateral line.

d. Body elongate; color rosy or silvery, especially on side; spots small----------
Rainbow Trout (Salmo irideus). Page 112

dd. Body rather deep.

e. A reddish lateral band.

f. Black spots largely restricted to the back, few below median line.

g. Vomerine teeth in a single zig-zag series----------
McCloud River Trout (Salmo shasta). Page 115

gg. Vomerine teeth in two irregular series----------
Noshee Trout (Salmo stonei). Page 116

ff. Entire body and all fins profusely black-spotted----------
Kern River Trout (Salmo gilberti). Page 118

fff. Heavily and uniformly spotted; fawn brown on sides----------
San Gorgonio Trout (Salmo evermanni). Page 117

ee. A greenish lateral band----------
Eagle Lake Trout (Salmo aquilarum). Page 116

cc. Extensive lemon yellow or orange on sides and belly.

h. Back and upper two-thirds of sides covered rather closely with small black spots; lower third of side, except on caudal peduncle, without spots---------- **Golden Trout of the Little Kern, or Soda Creek Trout** (Salmo whitei). Page 121

hh. Back and upper one-third of side sparsely black spotted; lower two-thirds of side, except on caudal peduncle, entirely without spots ---------- **Golden Trout South Fork of Kern** (Salmo agua-bonita). Page 123

hhh. Back, head, and entire side, except on caudal peduncle, entirely without spots; a few spots on the caudal peduncle----------
Roosevelt Trout (Salmo roosevelti). Page 124

bb. Scales small, usually about 150-200 in crosswise series; red marks under dentary bones always present; mouth large, the maxillary 1.6 to 2.25 in head; hyoid teeth present; irregularly and profusely scattered.

i. Black spots encroaching somewhat on belly----------
Cutthroat Trout (Salmo clarkii). Page 127

ii. Black spots sparsely scattered----------
Tahoe Trout (Salmo henshawi). Page 127

iii. No black spots; back bluish or greenish----------
Royal Silver Trout (Salmo regalis). Page 129

bbb. Scales so small as to be almost invisible, 200-250 in lateral series; no red on throat.

j. Sides with red spots.

k. Back unspotted, strongly marbled with dark olive or black ----------
Eastern Brook Trout (Salvelinus fontinalis). Page 130

kk. Back not marbled with olive or black; but spotted with red or orange----------
Dolly Varden Trout (Salvelinus parkei). Page 129

jj. Back and sides with gray spots----------
Mackinaw Trout (Cristivomer namaycush). Page 133

bbbb. Scales very large, 118-130 in lateral series; introduced species.

l. Adipose fin large, its width much more than half its length---------- **Brown Trout** (Salmo fario). Page 131

ll. Adipose fin small, its width one-half its length----------
Loch Leven Trout (Salmo trutta levenensis). Page 132

NATIVE SPECIES.

Steelhead Series.

STEELHEAD.

Salmo gairdneri Richardson.

Other names: Steelhead Trout; Steelhead Salmon; Salmon Trout; Hardhead.

Description: Head in length to base of tail fin 4.5 to 5; depth 4.5; eye 4.5 in head; dorsal 11; anal 11 or 12; branchiostegals 11 or 12; scales usually about 30-150-28, the cross-series varying from 130 to 180; pyloric cæca 42; gill-rakers, 8+12; vertebræ 38+20. Body rather stout, the caudal peduncle thick; head rather short and slender, only about twice length of maxillary; eye small; teeth small, those on vomer in two long, alternating series which are about as long as the palatine series; no hyoid teeth. Tail wide, squarely truncate in the adult, emarginate in the young. Color olive-green above, silvery on sides and belly; head, back, and dorsal and caudal fins more or less closely covered with small black spots. During the breeding season, side with a broad rosy or flesh-colored lateral band, deep rosy on the cheek, this often remaining through the year; fins not red; no red on lower jaw.

Marks for field identification: Large size; small head; large scales; bright silvery color; absence of red on lower jaw.

Distribution in California: The steelhead enters coastwise streams from Ventura River northward, ascending to their headwaters for spawning purposes and then returning to the sea.

The steelhead is more or less anadromous in its habits, it being migratory like the salmon, spending much of its time in salt water, and ascending freshwater streams at spawning time. It enters practically all the coastal streams of California from Ventura County on the south to the Oregon line; also from there to Skagway and Sitka. Many of the streams on the California coast are famous for their steelhead; special mention may be made of Ventura River, the Santa Ynez, Santa Maria, those entering Monterey Bay, and all the streams north of San Francisco, particularly the Russian, the Klamath, and the Eel.

As a game fish the steelhead is a favorite with the anglers. Its game qualities, together with its large size, make this one of the fishes most sought after by the followers of good old Isaak Walton. When in fresh water it will not only take the trolling spoon, but it will rise readily to the fly.

The steelhead is an excellent food fish, and its large size and abundance make it a fish of considerable commercial value. It is an important fish in the fish cultural operations of California and of other Pacific Coast states and the federal government. It has been introduced into Lake Superior and is now an abundant and much prized game fish in that lake and its tributary streams.

The fact that most ichthyologists and many anglers regard steelheads simply as sea-run individuals of rainbow trout has not escaped our minds, and we ourselves are inclined to accept that view. Nevertheless we know that in some places, they are entirely distinct and easily distinguishable. At any rate, we deem it best for our present purposes to treat the steelhead as a distinct species.

RAINBOW TROUT.

Salmo irideus Gibbons.

Other names: Mountain Trout; Speckled Trout; Brook Trout; California Trout. Sea-run form: Steelhead; Steelhead Salmon; Salmon Trout; *Salmo rivularis*, in part; *Salmo gairdneri*, in part.

—*From drawing by Charles Bradford Hudson*

STEELHEAD TROUT (*Salmo irideus, a sea-run form*)

Description: Head 3.8; depth about 4; eye 4.83 in head, 1.4 in snout; snout 3.6; D. 10; A. 11; scales 24-130-20, about 70 series in front of dorsal, counting along median line, or 60 if rows along upper side are counted; branchiostegals 11; gillrakers 8+13, rather long and slender. Head pointed, mouth, rather large, maxillary extending to posterior margin of eye, 1.8 in head, with about 20 teeth; preorbital very narrow, the maxillary almost touching the orbit; several large teeth along side of tongue; no hyoid teeth; teeth on vomer in zig-zag series; origin of dorsal at middle of length; origin of anal midway between that of dorsal and base of caudal; caudal broad, nearly truncate. Color, on the back a deep dark-blue ultramarine of a peculiar transparency, dotted with small round black spots about the size of a pin head; side abruptly brighter, with many scales silvery; lower parts white; sides, top of head, dorsal, and caudal fins covered with very small spots; pectorals and ventrals nearly colorless, without spots; adipose fin with two spots; no red on lower jaw.

Marks for field identification: Rainbow trout usually have a great many spots, which are more or less obscured by a silvery sheen in the sea-run examples. Average specimens are from 4 to 12 inches in length and weigh as much as 6 or 7 pounds, but average 3 or 4. Sea-run examples sometimes weigh 25 pounds. From the cutthroat trout the rainbow may be known by its larger scales, brighter coloration, and by the absence of red on the throat. The comparatively large scales (120-150) distinguish the true rainbow from the species found in the McCloud and Kern rivers.

Distribution: Native in all coastal streams and most streams of the interior, especially those of the western slope of the Sierras. Introduced in many lakes and streams of the state formerly barren of fish life.

The rainbow runs upstream in early spring to spawn, leaping over waterfalls and entering the small streams forming the headwaters. Here the eggs are deposited in the sand and the young are hatched out.

Fig. 38. Young steelhead trout. All young trout have black bars on the sides, which are known as parr marks.

By far the largest output of the state hatcheries is composed of rainbow trout, and there is good reason, for this is considered the best game fish of all and it is most highly prized by anglers. The rainbow often leaves the water in its eagerness to take a fly. In fact, so readily does it take a fly that there is seldom need to resort to bait or other lures.

This trout has thriven almost everywhere, having been introduced into New Zealand, Japan, Europe, and the eastern United States.

The rainbow varies in coloring according to age, sex, and location. Those individuals which are able to reach the sea spend part of each year there, returning to the freshwater stream a larger and more silvery-colored fish commonly called steelhead. Spawning fish travel far up the coastal streams and spawn high up in the small tributaries. Their habits in this regard are more like those of the salmon than those

of a trout. Unlike the salmon, however, the steelhead does not as a rule die after once spawning.

Specimens returning from the sea are usually silvery in color, but spotting soon appears in the freshwater stream. Because of its large size and excellent flavor the sea-run form is a splendid food fish. It is marketed in large quantities during the open season; as a game fish prized by anglers who troll in the bays and river mouths along the northern coast.

"In beauty of color, gracefulness of form and movement, sprightliness when in the water, reckless dash with which it springs from the water to meet the descending fly ere it strikes the surface, and the mad and repeated leaps from the water when hooked, the rainbow trout must ever hold a very high rank. The gamest fish we have ever seen was a 16-inch rainbow taken on a fly in a small spring branch tributary of Williamson River in southern Oregon. It was in a broad and deep pool of exceedingly clear water. As the angler from behind a clump of willows made the cast the trout bounded from the water and met the fly in the air a foot or more above the surface; missing it he dropped upon the water only to turn about and strike viciously a second time at the fly just as it touched the surface; though he again missed the fly the hook caught him in the lower jaw from the outside, and then began a fight which would delight the heart of any angler. His first effort was to reach the bottom of the pool, then, doubling upon the line, he made three jumps from the water in quick succession, clearing the surface in each instance from 1 to 4 feet, and every time doing his utmost to free himself from the hook by shaking his head as vigorously as a dog shakes a rat. Then he would rush wildly about in the large pool, now attempting to go down over the riffle below the pool, now trying the opposite direction, and often striving to hide under one or

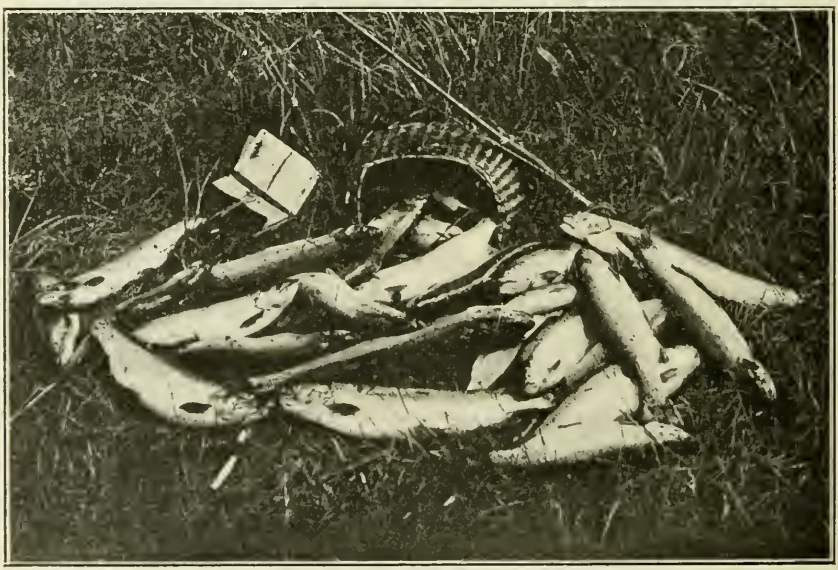

Fig. 39. Rainbow trout taken in Manzanita Lake, near Red Bluff, Tehama County, California.

—*From drawing by Charles Bradford Hudson*

RAINBOW TROUT (*Salmo irideus, a stream form*)

the other of the banks. It was easy to handle the fish when the dash was made up or down stream or for the opposite side, but when he turned about and made a rush for the protection of the overhanging bank upon which the angler stood, it was not easy to keep the line taut. Movements such as these were frequently repeated and two more leaps were made. But finally he was worn out after as honest a fight as trout ever made.

"The rainbow takes the fly so readily that there is no reason for resorting to grasshoppers, salmon eggs, or other bait. It is a fish whose gameness will satisfy the most exacting of expert anglers and whose readiness to take any proper lure will please the most impatient of amateurs." (Evermann.)

Spawning takes place in winter and early spring, varying with temperature and locality. The bulk of the eggs are usually taken in February, March, and April, although spawning continues through May in the mountain districts. The average yield from each female is about 900 eggs. A few of the females spawn when three years old, but about one-half of them begin at four years. The egg is from one-fifth to two-ninths of an inch in diameter; it has a pink color when first taken, becoming darker before hatching. The rainbow feeds on worms, insect larvæ, and salmon eggs. In streams in which the salmon and rainbow exist together, the rainbow is more destructive to the salmon eggs than any other species except the Dolly Varden.

McCLOUD RIVER TROUT.

Salmo shasta Jordan.

Other names: Shasta Trout; Shasta Rainbow. *Salmo gairdneri shasta; Salmo irideus shasta.*

Description: Head 4; depth 3.8; eye 5; D. 11; A. 11; scales 20 to 24-145-20, about 65 before the dorsal. Body comparatively short and deep, compressed, varying considerably, and much more elongate in males than in females; head short, convex, obtusely ridged above; mouth smaller than in most species of trout, the rather broad maxillary scarcely reaching beyond the eye, except in old males; eye large, about one-fifth length of head; vomerine teeth in two irregular series; dorsal fin moderate; caudal fin distinctly though not strongly forked, more deeply incised than in the typical cutthroat. Color, bluish above, the sides silvery; everywhere above profusely but irregularly spotted, the spots extending on the sides at least to the lateral line, and covering the vertical fins; top of head well spotted; fins usually not red; much red or rosy on cheeks and opercles; belly partly red in males; side with a broad but more or less interrupted red lateral band, brightest in males. (Jordan and Evermann.)

Marks for field identification: Differs from other rainbow trout, with the exception of that in the Klamath River, in its larger size, smaller mouth and larger eyes. Scales are intermediate in size between cutthroat and sea-run rainbow (steelhead), about 145 in transverse series. Caudal fin more deeply incised than in typical cutthroat.

Distribution: McCloud River and streams of the Sierras from Mount Shasta southward at least to Calaveras County.

This rainbow lives in water with a comparatively high temperature if it is plentiful and running with a strong current; but in sluggish water, even when the temperature is considerably lower, no species will do well. This species appears to inhabit the rapids more largely than the slow-moving water. The spawning season in California extends from early February to May. Males are good breeders at two years old, but the females rarely produce eggs until the third season. It may lack a little in the wild gaminess of the typical rainbow, but that is

made good by its larger size. It is largely an insect feeder and, therefore, a favorite of the fly fisherman.

This is the rainbow which has been most widely used in fish cultural operations and has been more widely distributed than any other variety.

NOSHEE TROUT.

Salmo stonei Jordan.

Other names: Nissuee Trout; Stone's Trout; Nissui Trout; *Salmo irideus stonei.*

Description: Depth 4; A. 11; eye 4.5; maxillary about 2; pectoral 1.3; scales 140 to 155, about 82 before the dorsal, where they are small and embedded; teeth fewer and smaller than in the Shasta trout, those on the vomer in a single zig-zag series. Color, upper parts plain greenish; spots few and confined chiefly to the posterior part of body; spots small and sparse on dorsal, adipose and caudal fins; a red lateral band usually distinct; cheeks and opercles with red; no red on throat. (Jordan and Evermann)

Marks for field identification: Much larger than typical rainbow, reaching a weight of 10 to 12 pounds; teeth are fewer and smaller than those of typical rainbow.

Distribution: Upper Sacramento Basin, especially in the McCloud River above Baird.

Voracious. Little is known about this trout.

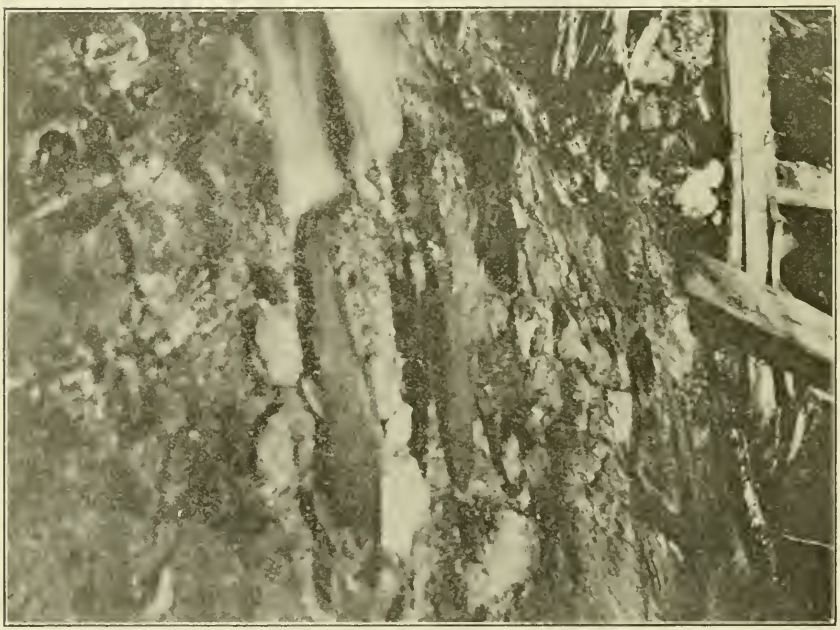

Fig. 40. Trout spawning. The female can be seen at the left digging up the sand preparatory to depositing eggs. The male is shown at the right. Photograph by J. H. Gyger, taken on Orchard Creek, San Bernardino Mountains, April 25, 1916.

EAGLE LAKE TROUT.

Salmo aquilarum Snyder.

Other names: *Salmo clarkii,* in part.

Description: Head 4.2 in length to base of caudal; depth 4.2; depth of caudal peduncle 9.8; eye 7.5 in head; interorbital space 3; snout 3.5; maxillary 1.9; height of dorsal 6.5 in length; adipose fin 12.5; length of caudal 4.8; pectoral 5.6;

ventral 7.5; height of anal 6.9; scales in lateral series 136. Body deep; caudal peduncle robust; head rather pointed; maxillary broad and long, extending far beyond posterior border of eye; edge of opercle 3.8 in head. Branchiostegals 11. Gillrakers 18, rather thick at base, pointed at tips, and decidedly sickle-shaped. Vomerine teeth in three series in front, the middle ones extending backward; teeth of palatines, maxillaries, and mandibles in a single series; glossohyal with teeth; basi-branchials without teeth. Scales large and deeply embedded; pores in lateral line 120; series of scales above lateral line, counting upward and forward to a point just before dorsal, 29. Scales of nape minute and closely crowded as are those of throat and abdomen. Axillary scales of ventral small, equal in length to vertical diameter of eye, sharply pointed. Dorsal rays 11, edge of fine concave; adipose dorsal very large, broad and thick; caudal broad and strong, the posterior edge slightly concave, the lower lobe a little longer than the upper; anal ray 11, edge of fin somewhat concave; pectorals strong and rather pointed; ventrals obtusely pointed.

Marks for field identification: Distinguished from other trouts of the Sierras by the robust body with a deep caudal peduncle and large and strong fins, conspicuous adipose fin, large scales, and the red color of cheeks and coppery red of under parts. The flesh is deep red, very firm and fatty, far superior to that of the Tahoe Trout.

Distribution: Eagle Lake and its tributary, Pine Creek.

The annual spawning migration occurs in May, when apparently the entire trout population of the lake attempts to move up Pine Creek. It is said that anglers do not succeed in catching trout in Eagle Lake, their failure being attributed to either a scarcity of fish or an abundance of food. (Snyder.)

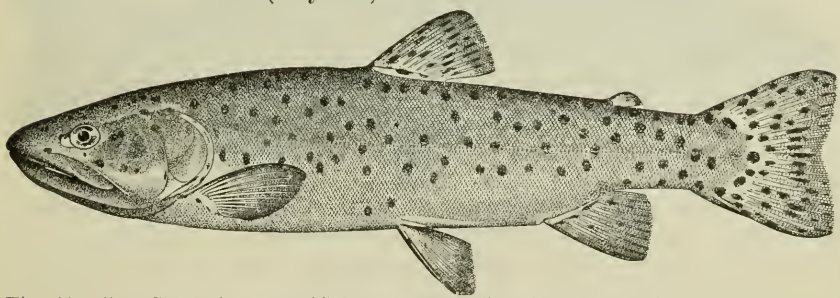

Fig. 41. San Gorgonio trout (*Salmo evermanni*). Found only in the upper Santa Ana River, Mount San Gorgonio, southern California.

SAN GORGONIO TROUT.

Salmo evermanni Jordan & Grinnell.

Other names: Evermann Trout: San Bernardino Rainbow Trout.

Description: Length of type, an adult male (as measured when first caught), 11.63 inches; head measured along side 2.75 inches. Head 3.63 in length to base of caudal, the jaws being somewhat produced; depth of body 4.7; eye 6.5 in head; maxillary 1.75 in head; dorsal with 10 rays, anal with 10; 34 scales between base of dorsal and lateral line, 167 oblique rows crossing lateral line, and 33 scales between lateral line and vent. Snout (from eye) 3.3 in head; anal 2 in head; ventral 2.2 in head; pectoral 1.37 in head; dorsal 1.57 in head. Caudal distinctly emarginate, or lunate. Vomerine teeth in two straight rows; hyoid teeth present, though buried in mucus; Maxillary extending well beyond eye, so that the mouth is relatively large. In the female, the head is shorter and the maxillary 1.8 in head. Coloration, very dark fawn-brown, the spots unusually large and covering the whole length of the body, none of the brilliant hues of *Salmo agua-bonita*, *rooseveltí* or *whitei*, nor even the crimson of *irideus*. Ground fawn-color along sides; varying toward seal brown dorsally; a large patch of same color on cheek; lower parts lighter (fresh tints unknown, but no red in throat region shown in the specimens); black spotting conspicuous, the spots evenly distributed, very large, on sides posteriorly the size of pupil

or larger, smaller on top of head; 25 on dorsal fin, mostly in four rows; caudal fin nearly as distinctly spotted as sides, with spots more closely set. Younger individuals are somewhat lighter, but yet considerably darker than *iridcus* of the same size, and the other characteristics seem to be constant.

Marks for field identification: Differs from the rainbow in small size and slightly different coloration. As compared with *Salmo irideus*, *Salmo evermanni* is slenderer, especially dorso-ventrally; the head is longer, the snout sharper, and mouth larger; the scales are very much smaller and more numerous, not overlapping; the colors are dull and very dark, and the spotting is heavy.

Distribution: Upper Santa Ana River in the San Bernardino Mountains of southern California.

Habits similar to other rainbows. It is probable that the San Bernardino trout is the older species in the region where found, and owes its preservation as a distinct species, and perhaps the accentuation of its characters, to isolation afforded by the barrier which prevents the invasion of the rainbow trout from the lower stream. In the remote history of the stream, the falls have doubtless shifted and become more effective, so that the ancestral stock of San Gorgonio trout was originally able to ascend to its present remote and limited habitat. (Jordan and Grinnell.)

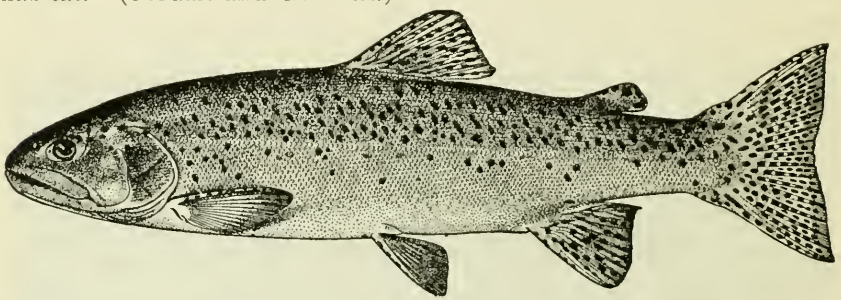

Fig. 42. Eagle Lake trout (*Salmo aquilarum*). Found only in Eagle Lake and tributary streams.

KERN RIVER TROUT.

Salmo gilberti Jordan.

Other names: Gilbert Trout; Kern River Rainbow Trout; *Salmo irideus gilberti*.

Description: Head 4 in length to base of caudal; depth 3.6; eye 5 in head; snout 4.3; maxillary 1.6; mandible 1.3; preorbital 20; scales small, about 165 in lateral line; dorsal fin with 14 rays; anal 12. Body stout, moderately compressed, deepest slightly in front of dorsal; head long, conic, snout pointed; mouth large, maxillary long and narrow, reaching more than an eye's diameter beyond the eye; mandible slightly curved; teeth on lower jaw rather strong, wide-set, in a single series, those on maxillary strongest; caudal peduncle stout, its least depth equal to snout and eye. Fins all well developed; origin of dorsal midway between tip of snout and base of tail, the longest ray nearly two in head, base of fin slightly greater than height; caudal broad, truncate, the lobes equal, exceeding height of dorsal; base of anal equaling height of dorsal; origin of ventrals somewhat posterior to that of dorsal and much nearer base of caudal than tip of snout, longest ventral ray equal to longest dorsal ray; longest pectoral ray exceeding by one-fourth the height of dorsal.

Color in life, head, body, and fins everywhere profusely and rather uniformly covered with small black spots, those on body stellate, those on fins oblong, those on head roundish and more sparse; inner half of ventrals with the anterior rays white at tip; adipose dorsal olivaceous with three or four black spots; side broadly rich rosy red, broadest and brightest near middle, least distinct on caudal peduncle; lower half of side slightly pink and pale bluish; belly with

slight irregular wash of old gold on dirty-white ground color; back and upper part of side olivaceous with fine yellow, orange, or lemon specks; cheeks and opercles rich rosy; little or no red on throat, no dash on membrane between rami of lower jaw; few spots on side of head; top of head olive green, well covered with round black spots.

This description is from an example (male) 18.25 inches long, weighing 3.5 pounds, taken by the senior author July 19, 1904, in Kern River about one-half mile above Kern Lake.

Marks for field identification: Profusely and closely spotted over the entire body, head, and on all the fins, the belly not so richly colored. It is similar to the McCloud River trout, but has smaller scales, about 165 in a transverse series. There is usually a distinct whitish tipping to the dorsal, ventral and anal fins.

Distribution: Kern, and probably Kings, Merced and other rivers of the southern Sierras. This species is abundant in Kern Lake and in the river for some miles below the lake, but of this we have no personal knowledge, as no collecting has been done below the lake. As a rule, the fish taken from the river are more deeply and brightly colored and decidedly more gamey than those from the lake. During the spawning season early in the spring the fish are found chiefly in the river, but after the spawning has been completed they tend to run down into the lake, where they become less active and less highly colored. Large examples from the lake are, as a rule, more slender than those from the river; probably on account of the fact that those from the lake are all spent fish.

The Kern River trout is a beautiful fish, well built and symmetrical, and very rich in coloration when in prime condition. As a game fish it will stand easily among the best, but, as already stated, in the river it greatly excels those of its kind in the lake. It usually takes the fly quite freely, and will, of course, take all sorts of live or cut bait. We have taken these trout "with the artificial fly, with grasshoppers (which they greatly preferred), and with pieces of fish or other meat. The large example from which the colored plate was made was first tried with a gray hackle, to which he rose once and then paid no more attention to it. A larger, plain hook and a good-sized grasshopper were substituted, with better results. Scarcely had the lure touched the water when he rose and struck most viciously, only to miss it, then turn and strike more viciously than before. This time the hook caught inside the mouth just under the middle of maxillary, and then began a fight that would delight a better angler than I. He first circled about in a wide curve, then jumped twice, clearing the water beautifully each time; circled again, went to the bottom in water ten feet deep, came to the surface and jumped again, after which no more leaps were made, but he continued dashing about until finally brought to net." (Evermann.)

THE GOLDEN TROUT OF CALIFORNIA.

The golden trout of California are, so far as known, found only in the headwaters of the Kern River, all in the vicinity of Mount Whitney. To be sure, through the activities of the California Fish and Game Commission and other agencies, their original distribution has been somewhat extended by transplanting.

Four species of trout are now recognized as native to the upper Kern River basin, namely: the Kern River trout or Gilbert trout (*Salmo gilberti*), the Soda Creek or White's golden trout (*Salmo whitei*), the South Fork of Kern golden trout (*Salmo agua-bonita*), and the Roosevelt trout or golden trout of Volcano Creek (*Salmo roosevelti*). All except the Gilbert trout are of the golden trout type.

All four of these species belong to the Rainbow Series, the species of which as a whole may be distinguished, with greater or less difficulty, from those of the Steelhead Series or sea-run rainbows on the one hand by the usually brighter colors, and on the other hand, from the Cutthroat Series by the absence of a red or scarlet dash on the throat and the entire absence of hyoid teeth.

The three species of golden trout differ as a group from the other recognized species of the Rainbow Series in having decidedly smaller scales and a very brilliant coloration.

When the first trout came to the beautiful streams of the southern High Sierra no one certainly knows; but it must have been long, long ago, as men count time, when melting ice filled the Valley of Death and the terrible deserts of Panamint and Amargosa with sweet waters. Long before that time trout had found their way into the Rio Colorado and when the ice came it was not hard for them to push westward to certain headwaters of the San Joaquin. Among the first to come were some that took up their home in the Great Kern, a wild, strange river, whose sources are among the highest of California's great mountains and whose course for many miles is almost meridional by the compass through a great canyon hundreds of feet deep and marvelous in its stupendous grandeur and beauty. In this river the trout were free to roam about as they liked. Sometimes they would go far down the stream and even out into that wonderful Tulare Lake, then much larger and much colder than it has ever been since. Then in early spring they would go the other way, even entering the tributary streams and penetrating to the little rivulets that trickle from the flanks of the great mountains and the banks of snow that never melt.

The waters in all these streams were clear and cold, and food was abundant. Some of the streams that came in from the east and others from the west already had formed considerable falls in their course above which the trout were not able to go. In some of the tributaries, such barriers were met with in the beginning and those streams are barren of fish to this day. In others, the invasion from the main stream began and was consummated before the falls became impassable, and trout are now found in them, although falls which fishes can not surmount have since been formed in many of them. Among tributary streams of this character which may be mentioned are Soda Creek, Coyote Creek, and the Little Kern on the west and Volcano Creek and South Fork of Kern River on the east. In the first three, the wearing down of the stream-bed and the formation of impassable falls prevented any subsequent invasions from the main river, isolated those colonies of trout which had pushed toward the headwaters, and prevented any further mixing of creek fish with river fish. But in Volcano Creek the conditions were exceptional and complicated. This stream derived its fish originally from Kern River, as did the other streams mentioned: impassable falls subsequently formed and the fish of the creek became shut off from those of the river. Then an unique factor was introduced. A period of volcanic activity ensued, during which the west half of the Toowa Valley was more or less filled with lava, volcanic tufa, and other igneous material, the lower half of Volcano Creek was for a time wiped out of existence, and every living thing in its waters below the tunnel killed. The only fishes of Volcano Creek that escaped this catastrophe were those individuals which had migrated well toward the headwaters

of the stream above the influence of the lava flow. But this creek was permanently shut off from any further invasions of trout from the river; and when its waters again began to flow to the Kern, the falls then formed were even greater barriers than before, and the trout of Volcano Creek became more thoroughly isolated.

The environment of Volcano Creek is very different from that of Kern River; it is that of a small stream, with clean gravelly granite bed in its upper and yellowish or blackish lava and yellowish tufa in its lower course, and with water clear, pure, cold, and turbulent. Contrasted with this is Kern River, a large stream, many yards wide and many feet deep, with current often sluggish and bed of fine sand or mud in many places.

These different environments were sure in time to modify and differentiate the fishes of the two streams. The law of cause and effect applies here as elsewhere in nature, and with equal force; different causes acting upon even the same thing will produce different results.

But geographical isolation (räumliche Sonderung) is the great primary factor in the production of new species. It is the potent agent which holds apart the two groups of individuals, preventing intermingling and confining each to the influences of its own peculiar environment.

In the production of new species in nature, it is not essential that the environments be greatly unlike, or unlike at all, if the groups of individuals being acted upon can be kept from interbreeding.

And thus the trout in Kern River and those in Volcano Creek went on developing, each group in its own way, the two becoming more and more unlike and acquiring structural and other characters by means of which the two forms may be readily distinguished. The trout of Volcano Creek has taken on characters not possessed by the trout of any other stream—very different indeed from those of the Kern River trout. These characters have become fixed, as is evidenced by the fact that they are essentially uniform among all the individuals of this creek. The Volcano Creek trout is therefore a different species from that found in Kern River.

As a result of the formation of impassable falls in the South Fork of the Kern, in the Little Kern, in Coyote Creek, and perhaps still other tributaries of the Kern, other colonies of trout that had invaded the headwaters of these streams became isolated, and in time they also became specifically distinguishable from those of the main Kern and all other streams, so that we now have, as already stated, four distinct species in the Kern River basin. They are the three species of Golden Trout, and the Kern River Trout which is the parent species from which the various species of golden trout have been independently derived.

LITTLE KERN GOLDEN TROUT.

Salmo whitei Evermann.

Other names: Coyote Creek Golden Trout; Soda Creek Golden Trout; White's Golden Trout.

Description: Head 3.22 in length; depth 3.68; eye 4.54 in head; snout 3.33; maxillary 1.72; mandible 1.66; interorbital 3.57; longest dorsal ray 2.08; longest anal ray 2.17; pectoral 1.66; ventral 2.17; caudal lobes 1.61. Body rather stout, moderately compressed; head conic; mouth large, oblique, jaws subequal; maxillary long and slender, reaching much beyond the eye; teeth on jaws,

tongue and palatines well developed; caudal peduncle deep, its least depth about equal to distance from tip of snout to middle of eye. Fins well developed; origin of dorsal somewhat nearer tip of snout than base of caudal fin; insertion of ventral about under middle of dorsal fin. Scales small, but noticeably larger than in the Volcano Creek trout.

Color in life, back and upper part of side light olive; side and back profusely covered with small roundish black spots, these extending on top of head, vertical fins, and on side below lateral line; side with 10 large roundish parr-marks and a broadish median band of light-brick or terra-cotta red; lower part of side light lemon-yellow with a number of bluish-black blotches, chiefly anteriorly, somewhat larger than similar ones on back; belly from tip of lower jaw at anal fin rich orange-red or cadmium, richest between pectoral and ventral fins, this band the full width of the belly; no red dash on throat; suborbital pale rosy or purplish; cheek brassy, with a large dark blotch; opercle rosy orange, olivaceous above; dorsal fin with about five rows of small round black spots and a black border except anteriorly, where the rays are tipped with a light-rosy border; pectoral light yellowish; ventral and anal reddish, with broad white edge; caudal profusely spotted with black like the dorsal fin. In spirits all the bright colors fade, but the black spots remain distinct. These spots are largest on the caudal peduncle, over which they are evenly distributed. They are also pretty evenly distributed over the entire side and top of head; the space along the lateral line, however, has fewer spots. Those below the lateral line extend more than halfway to the belly and are somewhat smaller than those above. About 14 spots show on side of head.

There is not much variation in color, as shown by examination of many examples. In all, the black spots completely cover the caudal peduncle and the entire length of side from median line of back to some distance below the lateral line; the top and sides of the head are always spotted. The middle line of the side and the belly are always richly colored, the parr-marks always present, and the dorsal, anal, and ventral fins bright-edged. No conspicuous red dash was observed on the lower jaw in any of the specimens from South Fork of Kaweah, Soda Creek, or Wet Meadow Creek, but among those from Coyote Creek were some showing considerable color.

Marks for field identification: The presence of small black spots on top of head and all but the lower one-third of the side distinguishes this golden trout from the two other species of golden trout.

Distribution: Soda Creek; Coyote Creek; Wet Meadow Creek; Little Kern River. The headwaters of the South Fork of the Kaweah were originally without trout but were stocked with fish from Soda Creek at Quinn's Horse Camp, and this species may, therefore, very properly be called the Soda Creek Trout.

This fish is known to reach a length of about ten inches. It takes the fly readily, and is a good fighter. Though less brilliant in color than the golden trout of Volcano Creek, it is in every respect a beautiful and attractive fish.

The following interesting account of the trout of the small streams of the High Sierras, by H. W. Henshaw, and written many years ago, applies chiefly to this species:

"This is the common brook trout of the small mountain streams of the Pacific slope, and up to an altitude of 9,000 feet it is the rare exception to find a suitable stream that is not well stocked with it. Upon many of them these trout are found in very great abundance, each pool and rapid numbering its finny denizens by the score. They may be taken in any sort of weather, at any hour of the day, by almost any kind of bait. During the heat of the day they frequent almost entirely the deeper pools, lying under overshadowing rocks or in the shade of some convenient log. In early morning or late afternoon they come out and run more into the shallows and rapids, under which circumstances they bite best and afford the finest sport. Like the average brook trout the species rarely attains any considerable size, ranging from four to eight or more inches in length. The character of the

bottom and water itself has much to do with color and I remember to have fished in a small rivulet on one of the subalpine meadows not far from Mount Whitney, whose sluggish waters flowed over a bottom of dark mud, in which the color of the trout simulated very closely its hue; they had lost nearly all the flashing irridescent tints characterizing the same species caught but a few hours before in another stream, and had become dull and somber-hued. Accompanying this change of color was a correspondingly noticeable difference in the habits and motions, and the several dozen trout caught that evening for supper were taken out by the hook with the display of very little more gaminess than would be noticed in so many horned pout. On the contrary, in the clear rapid current of the mountain stream, a flash of sunlight is scarcely quicker than the gleam of gold and silver, seen for a single instant, as the whirling waters are cut by one of the trout as he makes a rush from his lurking place for some chance morsel which is being borne past him. The Western trout are rarely as shy as their relatives of Eastern waters, and because of their numbers and consequent scarcity of food are apt to be less fastidious; yet even when most abundant due caution must be used if one would be successful, and not every one can catch trout even in the West. With the proper care in concealing one's self a pool may be almost decimated ere the alarm will be taken, and I have seen fifteen fair sized trout taken from a single small pool in quick succession."

This beautiful trout was named in honor of Stewart Edward White who suggested to President Roosevelt the investigation which resulted in its discovery.

SOUTH FORK OF KERN GOLDEN TROUT.

Salmo agua-bonita Jordan.

Other names: Mount Whitney Golden Trout; Golden Trout; Agua-bonita Golden Trout; *Salmo irideus agua-bonita.*

Description: Head 3.68 in length; depth 3.85; eye 4.4 in head; snout 4.4; maxillary 2.09; mandible 2.00; interorbital 3.66; longest dorsal ray 2.09; base of dorsal 1.8; longest anal ray 1.69; pectoral 1.63; ventral 2.00; caudal lobes 1.46; base of anal 2.1. Body stout, moderately elongate; head short, snout blunt; mouth moderate, maxillary extending somewhat beyond orbit, relatively broader than in the Kern River trout; teeth on jaws, maxillary, palatines, and vomer well developed; fins moderate; caudal peduncle compressed, its least depth equal to distance from tip of snout to posterior edge of pupil; scales relatively large.

Color in life, back and upper part of side light olivaceous; entire body above lateral line, including head, sparsely covered with rather large roundish black spots, those extending below lateral line on caudal peduncle; spots on side anterior to dorsal fin usually few; usually a few spots on median line of back between origin of dorsal and head; snout and top of head usually with a few spots; 2 or 3 spots sometimes on side of head; middle of side with a somewhat distinct rosy band, plainest at middle; parr-marks always present; side below lateral line light golden yellow; belly scarlet, brightest from ventral halfway to isthmus; under side of head, except jaw, reddish orange; cheek light golden yellow anteriorly, rosy or coppery posteriorly; dorsal and anal fins profusely spotted, the other fins with no spots, the anal dusky; adipose fin with edge black, and 2 small black spots; anterior dorsal ray tipped with reddish orange; ventrals and anal red, tipped with orange white; pectoral bronze. The above description chiefly from a specimen 7.75 inches long.

An examination of numerous examples shows some slight variations in the colors. The parr-marks are sometimes less regular, and the exact shade of the bright lateral band and the color of the belly vary somewhat. These, however, are simply differences in intensity rather than in pattern.

Marks for field identification: In this species the extent of the spotting on the body is the best diagnostic character. The South Fork of Kern trout are almost invariably well spotted, not only on the caudal peduncle but also along the side above the lateral line, at least as far forward as the front of the dorsal fin. There are also usually a few spots on the anterior part of side and along median line of back between dorsal and head; snout and top of head spotted, and usually a few spots on side of head; but there are no spots below the lateral line except on the caudal peduncle.

Distribution: South Fork of Kern River from which it has been introduced into the Cottonwood Lakes and Cottonwood Creek, and doubtless other streams.

This species was originally described by Dr. David Starr Jordan in 1893. His description was based on three small specimens conveyed to him by Mr. W. H. Shockley of San Francisco to whom they had been sent by Mr. George T. Mills, state fish commissioner of Nevada, who in turn had received them from Mr. A. C. Harvey of Lone Pine, Inyo County, California. A memorandum accompanying the specimens stated that they had been "taken by Mr. Harvey of Lone Pine, California, in a stream called by him 'Whitney Creek' (more correctly Volcano Creek), on the west side of the Sierras near Mount Whitney." It has since developed that these specimens did not come from Whitney (Volcano) Creek, but from Cottonwood Creek, a stream on the east side of the mountains and tributary to Owens Lake. Cottonwood Creek was stocked in 1876 by Messrs. A. C. Stevens, S. V. Stevens, and Thomas George with trout obtained by them in Mulky Creek, a small tributary of the South Fork of the Kern in Mulky Meadows, about 3½ to 4 miles from Cottonwood Creek. It is therefore evident that the specimens upon which Dr. Jordan based his description of *Salmo agua-bonita* were descendants of the trout from Mulky Creek transplanted into Cottonwood Creek in 1876 and are therefore the same species as that of the South Fork of the Kern. A comparison of specimens taken in the latter stream in 1904 with the type and cotype of *Salmo agua-bonita* shows them to be specifically identical.

ROOSEVELT TROUT.

Salmo roosevelti Evermann.

Other names: Volcano Creek Golden Trout; Golden Trout of Golden Trout Creek; Golden Trout; Golden Trout of Volcano Creek.

Description: Head 3.5 in length to base of caudal fin; depth 4; eye 5.6 in head; snout 3.4; maxillary 1.8; longest anal ray 1.9; pectoral 1.8; ventral 2.1; caudal lobes 1.8; base of dorsal 1.9; base of anal 2.6; least depth of caudal peduncle 2.6. Body stout, moderately compressed; head conic, rather long; snout long; jaws subequal, mouth large, somewhat oblique; maxillary long and narrow but slightly curved, extending much beyond orbit; teeth well developed mandible, maxillary, palatines, front of vomer, and on front of tongue, the latter in two rows; caudal peduncle very stout. Fins all strong and well developed; origin of dorsal midway between tip of snout and base of caudal peduncle; base of ventrals under middle of dorsal; caudal broad, strong, little notched when fully spread; anal with its free edge somewhat falcate. Scales exceedingly small, smaller than in any other known species of trout, nonimbricated, and scarcely showing unless dry; there are about 50 in an oblique series from front of dorsal downward and backward to the base of the ventrals; there are about 200 scales in the lateral line, 140 to 150 of them having pores.

Color in life, back, top of head, and upper part of side very light yellowish olive; middle of the side from gill-opening to adipose fin with a broad bright rosy band, the greatest width of which is about equal to greatest diameter of orbit; side below lateral line bright golden yellow, fading below into yellowish white; belly with a broad cadmium or deep orange-red band from throat to anal fin, the color deepest between pectoral and ventral; some red on belly between

origin of anal and base of caudal; about 10 roundish or vertically oblong parr-marks on middle of side, upon which apparently the rosy lateral band is superimposed; 3 of these parr-marks are on the caudal peduncle posterior to the adipose fin, 2 between the adipose and dorsal fins, 2 under the dorsal, and 3 anterior to it; between the first and second large parr-marks and somewhat below them is a small round spot of the same color, and there is a similar one between the fifth and sixth spots; cheeks and opercles bright rosy, edged posteriorly and below with yellowish, an olivaceous blotch on upper part of cheek and a small black spot on upper part of opercle; region about eye olivaceous yellow, especially below; lower jaw rosy, with some yellowish, membrane between rami of lower jaw whitish, without rosy wash, tip of lower jaw olivaceous; mouth on sides and below tongue orange, whitish elsewhere; side of caudal peduncle with about 30 small roundish black spots, these most numerous on posterior half, there being only 3 anterior to the adipose dorsal fin; rest of body entirely without spots; dorsal fin with about 6 irregular series of small roundish black spots, those toward the distal portion largest and blackest; general color of dorsal fin light olivaceous yellow, the tips of the anterior rays with a broad margin of whitish orange; adipose dorsal olivaceous, narrowly bordered with black, and with 2 small round black spots; caudal fin profusely spotted with black, the spots arranged irregularly in about 8 or 10 vertical rows; those at the base blackest and roundest, those on the distal edge somewhat linear, those on the outer edges of the lobes extending forward onto the dorsal and ventral lines of the caudal peduncle; general color of caudal fin yellowish and olivaceous, the lower lobe somewhat rosy; pectoral red, somewhat lighter than lateral band; ventral reddish, the anterior rays edged with white; anal reddish with a little orange, the anterior half or two-thirds broadly edged with white.

There is not much variation in color, except such as is probably due to difference in age; the rosy lateral band, the parr-marks, and the broad rich cadmium band on the belly are characteristic. The variation in the black spots is inconsiderable. In the 29 specimens which the senior author has examined critically 15 do not show any spots whatever anterior to the adipose fin, and only 2 of the remaining 14 show any spots anterior to the dorsal fin, and these are obscure and few in number. In one large specimen there are but 12 to 14 spots on the caudal peduncle; in another somewhat smaller example there are but 6 spots. The dorsal, anal, and ventral fins are invariably edged with color. The head in the males is longer and more pointed; the maxillary is also longer than in the females.

When well spread the caudal fin is usually slightly lunate or slightly notched, but in some examples it is almost truncate or square. In alcohol all of the bright colors soon fade, the parr-marks, black spots, and pale edges to the dorsal, anal, and ventral fins persisting. The general color of the body then becomes a dirty yellowish white or in some specimens brownish. In some cases the parr-marks almost wholly disappear.

Marks for field identification: The rich rosy lateral band showing through the large distinct bluish-black parr-marks, the rich lemon-yellow of the lower half of the side, the intensely rich cadmium of the belly, and the entire absence of black spots on the body except on the caudal peduncle, readily distinguish the Roosevelt trout from all other species.

Distribution: The golden trout is native to Volcano Creek alone, and occurs throughout the entire length of that stream. It is found at all places from above the tunnel to below the lowermost of the series of falls near the mouth, and in all suitable places from the tunnel to the headwaters above Volcano Meadows, where the elevation is more than 10,000 feet.

Trout are abundant in Volcano Creek; every pool at the foot of a fall or below a cascade or rapid is sure to contain a number of them, and they may be seen on the riffles and under the protecting banks. Although the fish runs down Volcano Creek even to below the lowest falls, it apparently does not venture out into Kern River; no examples were seen there. It is a creek fish and appears to keep within the peculiar environment of the small stream. They are most numerous above the tunnel, probably because fewer tourists visit that portion of

the stream. The fish there, however, are usually small. The largest, finest examples are found between the natural bridge and the lower falls.

As a game fish the golden trout is one of the best. It will rise to any kind of lure, including the artificial fly, and at any time of day. A No. 10 fly is large enough, perhaps too large; No. 12 or even smaller is much better. In the morning and again in the evening, it will take the fly with a rush and make a good fight, jumping when permitted to do so; during the middle of the day it rises more deliberately and may sometimes be tempted only with grasshoppers. It is a fish that does not give up soon but continues the fight. Its unusual breadth of fins and strength of caudal peduncle, together with the turbulent water in which it dwells, enable it to make a fight equalling that offered by many a larger trout.

Although now abundant the golden trout can not long remain so unless afforded some protection. The attractiveness of the Kern River region because of its scenic beauty is sure to appeal more and more to tourists every year. Practically the entire length of Volcano Creek is easily accessible from the trail from the east side of the divide. As a matter of fact, one can in one day travel the entire length of the creek and have time to stop frequently to drop a fly into the pools which he passes. The trout are readily found and easily captured, as they are so voracious and rise to the lure so readily.

The great beauty of the Roosevelt trout lies in the richness of its colors and in its trimness of form; the brilliancy and richness of its coloration is not equaled in any other known species of trout. The delicate golden olive of the head, back, and upper part of the side, the clear golden yellow along and below the lateral line, overlaid by a delicate rosy lateral band, and the marvelously rich cadmium of the under parts, fully entitle this to be known above all others as *the* golden trout. Except on the caudal peduncle, the body is entirely without the black spots characteristic of the rainbow trout series. One can appreciate to some extent the great beauty of this fish by examining the splendid painting by Hudson.

In form it is no less beautiful; its lines are perfect, the fins large and well proportioned, and the caudal peduncle strong; all fitting it admirably for life in the turbulent waters in which it dwells. It is a small fish, however. It is probable that it never attains a greater length than 14 inches or a weight of more than a pound in Volcano Creek. In the Cottonwood Lakes it is said to reach a weight of five pounds.

The scales are smaller than in any other known species of trout. They are so small, indeed, as to have caused so good an observer as Stewart Edward White to declare that this trout has no scales at all. This is an error in observation that is not uncommon; even James Russell Lowell, excellent naturalist that he was, wrote:

> "One trout scale in the scales I lay
> (If trout had scales), and it will outweigh
> The wrong side of the balances."

But all trout have scales, albeit often very small and not easily seen except by him who knows fishes, and the golden trout scales are the smallest of them all.

This, the most beautiful trout in all the world, was named in honor of Theodore Roosevelt, the naturalist, who, as President of the United States, ordered the investigation which resulted in its discovery as a new species.

Cutthroat Series.

CUTTHROAT TROUT.

Salmo clarkii Richardson.

Other names: Black-spotted Trout; Columbia River Trout; Clark Trout; Red-throated Trout.

Description: Head 4; depth 4; D. 10; A. 10; cæca 43; scales small, in 150 to 170 cross-series. Body elongate, compressed; head rather short; mouth moderate, the maxillary not reaching far beyond the eye; vomerine teeth as usual set in an irregular zig-zag series, teeth on the hyoid bone normally present, but often obsolete in old examples; dorsal fin rather low; caudal fin slightly forked (more so in young). Color, silvery olivaceous, often dark steel color; back, upper part of side and caudal peduncle profusely covered with rounded black spots of varying sizes and shapes, these spots often on the head, and sometimes extending on the belly; dorsal, adipose, and caudal fins covered with similar spots about as large as the nostril; *inner edge of the mandible with a deep-red blotch*, which is a diagnostic mark; middle of side usually with a diffuse pale rosy wash, sometimes quite bright, and extending on side of head; under parts silvery white. The red blotches or washing on the membrane joining the dentary bones of the lower jaw are usually constant, probably always present in the adult, and constitute a most important character. (Jordan and Evermann)

Marks for field identification: Red marks on throat; very small scales, there being about 150 in a row from head to tail; back profusely spotted; teeth present on hyoid bone at base of tongue.

Distribution in California: Pit River and tributaries, Eel River, coastal streams of northwestern California, Goose Lake.

Spawns in spring. Decidedly a deepwater fish, except during spawning season when it seeks shallower waters. Cutthroats do not rise as readily to a fly as other trout, but more often take a sunken fly; nor do they seek swift water as the rainbow. As a rule, this species does not rank with others in its gameness. Apparently, the cutthroat in this state is not as prolific as the rainbow; at least this species is not nearly so abundant as the rainbow. The cutthroat spawns in the spring and early summer, ascending to the headwaters of streams or depositing eggs in shallow water or on sand bars in the lakes. Lake cutthroats invariably reach a larger size than stream fish. Specimens in the Klamath Lakes have reached a weight of seventeen pounds.

TAHOE TROUT.

Salmo henshawi Gill & Jordan.

Other names: Black-spotted Trout; Silver Trout; Redfish; Tommy; Black Trout; *Salmo tahoensis; Salmo purpuratus henshawi; Salmo mykiss* (in part); *Salmo mykiss henshawi; Salmo clarkii henshawi.*

Description: Head 3.75; depth 4; D. 11; A. 12; scales 27 to 37-160 to 184-27 to 37, usually about 170 in a longitudinal series; body robust, elongate, greatest depth about one-fourth of total length without tail; caudal peduncle about two-fifths length of head; head long, conical, slender, not extending far behind eye; two long series of vomerine teeth; caudal short and distinctly forked; dark olive-green above, covered almost entirely with large black spots; males a dark yellowish-olive color, with metallic reflections, the dark color being the same

from the back to the ventral surface; a broad, pinkish, indefinite stripe about 10 scales wide on the side, each scale included in this stripe and also in a broad area above and below slightly edged with light yellow; opercle, preopercle, subopercle, and a triangular spot above the axil of pectoral, scarlet or yellowish scarlet; under surface of lower jaw with two parallel stripes of red; red also visible on the tongue and on the shoulder-girdle; brownish-black spots distributed over the entire body; females usually more lightly colored, and the colors seeming to have more metallic luster.

Marks for field identification: The dark olive body with many bold black spots widely scattered almost uniformly over its entire surface, and the red marks on the throat distinguish the Tahoe trout. Sometimes it has a silvery luster. Although plainly belonging to the cutthroat series, having the same red dashes under the throat, long head, small scales and teeth on the tongue, it is nevertheless, browner or yellower in color, and has larger scattered spots which cover the whole fish.

Distribution: Lake Tahoe and its tributary streams and lakes, upper portions of the Truckee River, Donner, Webber, and Independence lakes; introduced in lakes of Siskiyou County, and Bear Lake, San Bernardino County, and in the Stanislaus and the Mokelumne rivers on the western slope of the Sierras.

Anglers usually point out the following different kinds of trout in Lake Tahoe and the Truckee River:

Tahoe Trout, dark in color with large spots.

Silver Trout, silvery in color, with small, elongate spots, body deep and heavy.

Redfish, brilliant in color, with red cheeks.

Tommy, small, relatively large spotted fish, spawning later than the redfish.

Royal Silver Trout, deep blue above and silvery on sides with few or no spots. (*Salmo regalis.*)

Even though known to fishermen, these forms with the exception of the royal silver trout are here all classed as Tahoe trout, until further information is available.

There has been a great deal of speculation over the identity of the redfish, a large brightly-colored fish with a red cheek spot, which runs up the Truckee River early in spring, the migration ceasing in March. By many this is regarded as entirely distinct from the Tahoe trout. With the conclusion of this run of fish there appears a run of smaller fish known to the anglers as tommies. This second migration usually occurs in April and is about over by May 1. The tommy is a smaller and relatively large spotted fish. Whether these two forms which have separate spawning seasons are one and the same fish is yet to be determined, but at present they are given the same name. (Snyder.)

Frequently, a very light-colored silvery example of Tahoe trout is taken, its sides having a bright metallic luster and smaller and more elongate spots. This is usually known as the silver trout, and is said to frequent the greater depths. It attains a very large size, one having been caught which weighed 29 pounds. This form was described by Jordan and Evermann as *Salmo tahoensis* and may be, as they thought, a distinct species.

During a portion of the year the Tahoe trout lives in deep water, and can be caught, if at all, only on long lines. Early in the spring

and in the summer they are to be found in relatively shallow water. It may be that food supply accounts for this migration from deep to shallow water, as spawning minnows seem to be the attractive food when the trout is in shallow water. The greater number of this species are taken by trolling with a spoon. (Snyder.)

The Tahoe trout appears to feed largely on minnows but black ants and other insects are taken in quantity.

ROYAL SILVER TROUT.

Salmo regalis Snyder.

Other names: Greenback; Grayback.

Description: A fresh specimen is characterized by a deep steel blue on the dorsal surface which color extends downward on the sides to about the sixth row of scales above the lateral line, where it abruptly blends into a silvery hue. The silver dulls ventrally, while the chin, throat, and abdomen are white. The cheek is marked by a faint red or yellow spot glowing faintly through the silver, but this is the only red or yellow color on the fish. The dorsal and caudal fins are the only portions of the body marked by dark spots, but even these are inconspicuous. It has about 144 to 150 lateral series of scales, 29 to 31 above the lateral line, 11 to 13 branchiostegals, and 19 to 21 gillrakers. No external sex differences can be observed. (Snyder)

Marks for field identification: The Royal Silver trout, easily confused with silvery specimens of the common Tahoe trout (*Salmo henshawi*), differs from the latter in its decidedly silvery sides, blue back, shorter head, shorter and more rounded snout, smaller maxillary, large scales, narrow and more pointed fins, perfectly smooth basi-branchials which are without teeth, and fewer gillrakers. The absence of spots is also characteristic.

Distribution: Known only from the Lake Tahoe basin.

Little is known about its habits, but apparently it does not spawn in streams tributary to Lake Tahoe, as does the Tahoe trout. Feeds largely on insects, but doubtless also takes minnows, as it has been caught on a spinner.

Native Charrs.

DOLLY VARDEN TROUT.

Salvelinus parkei (Suckley).

Other names: Malma; Salmon Trout (Alaska and Montana); Bull Trout (Idaho); Western Charr; Oregon Charr; *Salvelinus malma* (in part).

Description: Head 3.5 to 3.75; depth 4.8 to 6; eye 6.5 to 7; snout 3 to 4; maxillary 1.7 to 3; D. 11; A. 9; scales 39-240-36; pyloric cæca large, 45 to 50; gillrakers about 8 to 12. Body rather slender, the back somewhat elevated, less compressed than in *Salvelinus fontinalis;* head large, snout broad, flattened above; mouth large, the maxillary reaching past the eye; fins short, the caudal slightly forked or almost truncate. General color, olivaceous, the sides with round red or orange spots nearly as large as the eye, the back with similar but smaller spots, and without reticulations, a feature of coloration which at once distinguishes this from all other American trout; lower fins colored much as in *S. fontinalis*, dusky with a pale stripe in front, followed by a darker one. (Jordan and Evermann.)

Marks for field identification: Distinguished from true trout and from other charrs by the lack of reticulations or mottling in its color pattern. Large orange or red spots on the back as well as sides, and the lack of blackish marblings on the upper fins, distinguish it from the Eastern Brook trout. It may weigh, when mature, anywhere from six ounces to twelve pounds. The little ones are brightest in color.

Distribution: The only stream in California in which the Dolly Varden trout is known to be a native is the McCloud River.

The Dolly Varden is more voracious than the true trout. In Alaska streams it devours millions of salmon eggs, as well as young salmon and this fish is the greatest enemy the salmon breeder finds. Gamy and vigorous, it makes a fair game fish, taking a baited hook freely. They also rise readily to the artificial fly. Their food is principally minnows. In California, the Dolly Varden is largely nonmigratory. It lies on the bottom and waits for food to come to it, then grabs it like a mad bulldog. When caught it will often actually attempt to defend itself by biting. Moreover, it will live longer out of water than other trouts.

When this fish was taken by scientists in the McCloud River, the resemblance to a dress goods with spots called Dolly Varden and which was then the rage, led to its being given this name by the lady members of the party, and "Dolly Varden" it has been ever since.

Fig. 13. Dolly Varden trout (*Salvelinus parkei*). A charr, not a true trout, found in this state only in the McCloud River.

Introduced Species.

EASTERN BROOK TROUT.

Salmo fontinalis (Mitchill).

Other names: Brook Trout; Speckled Trout; Fontinalis.

Description: Head 4.5; D. 10; A. 9; scales 37-230-30; gillrakers about 6+11; body oblong, moderately compressed, not much elevated; head large, but not very long, the snout bluntish, the interorbital space rather broad; mouth large, the maxillary reaching beyond orbit; eye large, somewhat above axis of body; caudal fin slightly lunate in the adult, forked in the young; adipose fin small; pectoral and ventral fins not especially elongate. Color, back more or less mottled, marbled, or barred with dark olive or black, without spots; red spots on side rather smaller than the pupil; dorsal and caudal fins mottled with darker; lower fins dusky, with a pale, usually orange, band anteriorly, followed by a darker one; belly in the male often more or less red. (Jordan and Evermann.)

Marks for field identification: Small imbedded scales making the fish appear scaleless; mottled or marbled color pattern of back with no spots, and red lower fins fringed with white, are the best distinguishing features.

Distribution: Tahoe region, Sierran lakes and streams; planted in most streams from Siskiyou to San Diego County, with the exception of the coastal streams. This fish now has the widest distribution, in California, of any introduced species.

Eastern brook trout abound chiefly in cold, slow-running meadow brooks; but they thrive in all pure cold waters which contain sufficient

—*From drawing by Charles Bradford Hudson*

EASTERN BROOK TROUT *(Salvelinus fontinalis)*

air, including lakes and ponds. Never, in California, are they found in fast-rushing mountain streams. This fish is wary, and great skill is required in catching it. The outstanding peculiarity of its habits is evidenced by the fact that a person acquainted with its haunts can go out and catch a string of Eastern brook in a comparatively short time, while others, with better tackle and equal skill, will fish a whole day for them in vain. The largest brook trout are found in the deep, wide pools in the warmer waters; the smallest ones are found in the cold, narrow mountain rivulets near their source. Eastern brook trout do not keep well nor ship well, probably on account of the fat. They spawn high up in the tributary streams and so early (October to January) that eggs for hatchery purposes are almost impossible to obtain. This trout is a nest-builder. "Cavities are made in gravel, the nest is shaped with the tail. * * * After the eggs are deposited they are covered with gravel. The egg is about one-fifth of an inch in diameter, and varies in color from pale lemon to orange red. The average yield of the female is from 400 to 600. The period of hatching will depend on the temperature, ranging from 165 days in water of 37 degrees to 32 days in water of 54 degrees. The yolk sack is absorbed in from 30 to 80 days, and after its absorption the young fish begins to feed. The rate of growth will, of course, depend on the amount of food consumed. In artificial culture yearlings, according to Mr. Ainsworth's estimate, will average 2 ounces; fish of two years, 4 ounces; of three years, 8 ounces, and of four years, 1 pound." (Bean.)

History. The California Fish Commission purchased 6,000 Eastern brook trout in 1872, and distributed them equally in the North Fork of the American River, in the headwaters of Alameda Creek, and in the San Andreas reservoir, near San Francisco. In 1875, a large shipment of eggs, 60,000, was received from New Hampshire and succeeding shipments in 1877, 1878, and 1879. Beginning in 1890, large numbers have been hatched and distributed each year. More recently, eggs for the hatcheries have been secured from the Marlette-Carson hatchery in Nevada.

BROWN TROUT.

Salmo fario Linnæus.

Other names: von Behr Trout; European Brown Trout.

Description: D. 13-14; A. 10-11; P. 13; V. 9. Scales 25-20-30; pyloric cæca 38-51; vertebræ 57-58. Body short and stout, its greatest depth being contained about four times in the length without the caudal. The caudal peduncle is short and deep, its depth equal to two-fifths of the length of the head. Length of head is one-fourth of total length without caudal. Dorsal fin is nearer to tip of snout than to root of tail; longest ray of this fin equals the distance from the eye to the end of the opercle. Ventral is under the posterior part of the dorsal; its length is about one-half that of the head. The adipose dorsal is over the end of the anal base. Pectoral nearly one-sixth of length without the caudal. In the male the jaws are produced and very old ones have a hook. The maxilla extends to the hind margin of the eye. On head, body and dorsal fin are numerous red and black spots, the latter circular or X-shaped and some of them with a pale border; yellowish margin usually present on the front of the dorsal and anal and the outer part of the ventral. The dark spots are few in number below the lateral line. The ground color of the body is brownish or brownish black, varying with food and locality. (Bean.)

Marks for field identification: The back and sides of this trout are decidedly brown; the back is covered with black spots and the sides with red spots. The belly is silvery white or brownish. This trout is not easily confused with others.

Distribution: A pure strain is to be found in the Yosemite Valley region; streams of northern Humboldt and Lake County. Hybrids, the result of a cross with the Loch Leven, are found in many other streams in the state.

The brown trout lives in clear, cold, rapid streams and at the mouths of streams tributary to lakes. It grows to be of large size; maturing at about 8 inches in length. In its movements it is swift, and it leaps over obstructions like the salmon. It feeds usually in the morning and evening, is more active during evening and night, and often lies quietly in deep pools or in the shadow of overhanging bushes and trees for hours at a time. Insects and their larvæ, worms, mollusks, and small fishes

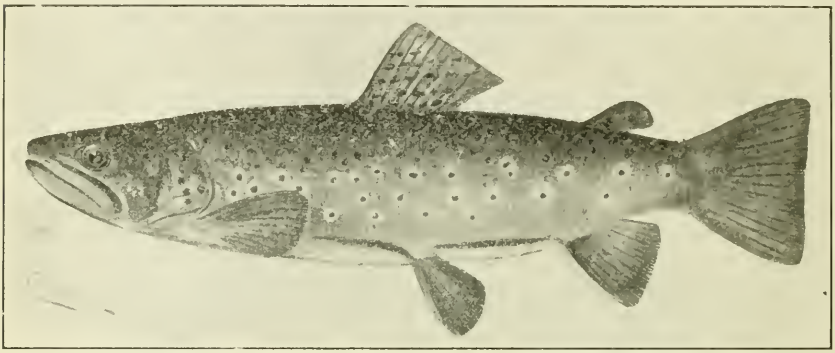

Fig. 44. Brown trout (*Salmo fario*) introduced into California about 1895. Now distributed widely in our state.

form its food, and, like its relative, the rainbow trout, it is fond of the eggs of fishes. Spawning begins in October and continues to January. Eggs are deposited in crevices between stones, under projecting roots of trees, and sometimes in nests excavated by the spawning fishes. The parents cover the eggs to some extent with gravel. (Bean.)

History. Several plants of brown trout were made by the United States Bureau of Fisheries previous to 1895, but in that year 135,000 were reared at the Sisson hatchery. With the exception of those held in the breeding ponds these fish were planted in the lakes and streams of the high Sierras.

LOCH LEVEN TROUT.

Salmo trutta levenensis Walker.

Other names: *Salmo levenensis;* Scotch Trout.

Description: D. 13; A. 12; P. 14; V. 9. Scales 24 to 28—118 to 130—26-30; pyloric cæca 47-90; vertebræ 56-59. Body slender and elongate, its greatest depth contained four and one-fourth to four and one-half times in total length without caudal. Caudal peduncle slender, its least depth three-eighths of the greatest depth of the body, and equal to length of snout and eye combined. Head rather short and conical, its length two-ninths to one-fifth of the total length without caudal. The snout is one-fourth or slightly more than one-fourth as long as the head. The interorbital space is somewhat convex, its width equal to three-fifths of the length of postorbital part of head The eye is of moderate size, its long diameter contained five and one-half to six times in the length of the head, and equalling about twice the greatest width of the maxilla. Maxilla reaches to or slightly beyond the hind margin of the eye. Teeth rather strong, those in the intermaxillary and mandible the largest, triangular head of vomer with two or three in a transverse series at its base,

teeth on the shaft of the vomer usually in a single, partially zig-zag, persistent series. Mandible without a hook and little produced even in breeding males. Dorsal origin distant from tip of snout about as far as end of dorsal base from base of caudal; the dorsal fin higher than long, its longest ray equal to longest ray of anal fin. The anal fin is much higher than long, its distance from the base of the ventral equaling length of the head. The ventral origin is nearly under the middle of the dorsal, the fin being as long as the postorbital part of the head. Pectoral equals length of head without the snout. Adipose fin very small, its width one-half its length, which is about equal to eye. Caudal fin emarginate unless fully extended, when it becomes truncate, the outer rays about one-seventh of total length, including caudal. (Bean)

Marks for field identification: The true Loch Leven trout is a slimmer fish than the brown trout, and the adipose fin is smaller. Furthermore, it is fully spotted and lacks the brown color of the brown trout. The sides are silvery with a varying number of X-shaped black spots or rounded brown or black spots.

Distribution: Webber Lake in Sierra County has pure original stock. Common to California streams: Feather River, Tahoe region, and Siskiyou County lakes and streams, but usually crossed with brown trout.

The spawning season may begin in October and continues till January. According to W. H. Shebley, the egg is slightly smaller (260 to a fluid ounce) than the egg of a rainbow (220 to a fluid ounce) but larger than that of an Eastern brook (345 and 400 to fluid ounce).

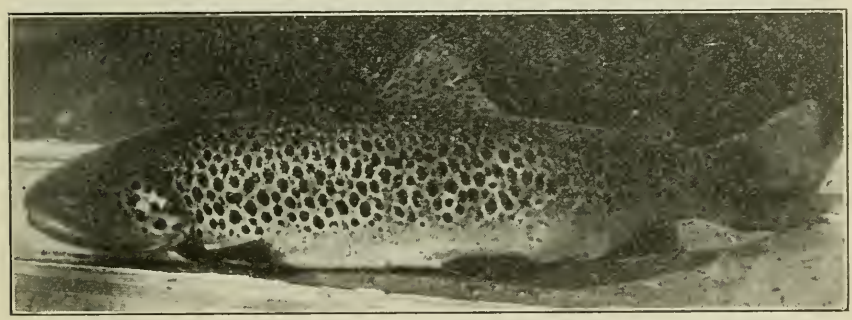

Fig. 45. Loch Leven trout (*Salmo levenensis*). A native of Scotland. Introduced into California in 1894, and now a common fish in Sierra streams, but often crossed with the brown trout.

This trout is largely nonmigratory in its native habitat. It takes the artificial fly readily. The food of this species includes fresh-water mollusks, crustaceans, worms, and small fish.

History. Twenty thousand Loch Leven trout eggs were received at the Sisson hatchery in 1894. Since that time plants have been made annually from the fry reared at this hatchery. Most of the fish in the breeding ponds at present are hybrids secured by crossing with the brown trout. Hybridization between these two species is very common.

MACKINAW TROUT.

Cristivomer namaycush (Walbaum).

Other names: Great Lakes Trout; Cristivomer; among the Canadian Indians called the "namaycush."

Description: Head 4.25; depth 4; eye 4.5; Br. 11 or 12; D. 11; A. 11; scales 185 to 205; maxillary 2; interorbital 4. Body long; head very long, its upper surface flattened; mouth very large, the maxillary extending much beyond the eye, the

head and jaws proportionately lengthened and pointed; caudal fin well forked; adipose fin small; teeth very strong. General coloration, dark gray, sometimes pale, sometimes almost black, everywhere with rounded pale spots which are often reddish tinged; head usually vermiculate above; dorsal and caudal reticulate with darker.

Marks for field identification: Largest of all trouts and known by its cream-colored or grayish spots instead of red spots as in the true charrs. The dorsal and caudal fins are marked.

Distribution: Introduced in Lake Tahoe, Fallen Leaf and Donner lakes, where it is occasionally caught.

Omnivorous in its feeding habits; it has a ravenous appetite, greedily devouring all kinds of fishes possessing soft fins. It is even said that jackknives, corncobs and other equally indigestible articles have been found in its stomach. It spawns on reefs and lives in deep water at other times. The spawning season begins late in September, and spawning continues until December.

The Mackinaw trout reaches a much larger size than a charr, specimens of from 15 to 20 pounds weight being not uncommon, while it

Fig. 46. Mackinaw trout (*Cristivomer namaycush*). A large trout native in the Great Lakes. Now occasionally taken in the Tahoe region, where it was introduced in 1894.

occasionally attains a weight of 50 to 80 pounds in the Great Lakes. As a food fish it ranks high, although it may be regarded as somewhat inferior to the brook trout or the whitefish. Compared with other salmonoids, the Great Lakes trout is a sluggish, heavy, and ravenous fish. "According to Herbert, a coarse, heavy, stiff rod, and a powerful oiled hempen flaxen line on a winch, with a heavy sinker; a cod-hook baited with any kind of flesh, fish, or fowl—is the most successful, if not the most orthodox or scientific mode of capturing him. His great size and immense strength alone give him the value as a fish of game; but when hooked he pulls strongly and fights hard, though he is a boring, deep fighter, and seldom if ever leaps out of the water, like the true salmon or brook trout." (Jordan.)

History. First brought to California in 1894, the Mackinaw trout was propagated at the Sisson hatchery, and the following year 65,000 were planted in Lake Tahoe. In succeeding years additional plants were made in the Truckee basin. This fish has not thrived as well as other introduced species.

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Fig. 47. Planting fish in the High Sierras.

SUMMER ON THE CALIFORNIA TROUT STREAMS.

By ROBERT PAGE LINCOLN, Associate Editor of "Rod and Gun in Canada."

Trout fishing California has in plenty, with the added attraction of picturesqueness afforded by cool valleys, and overlooked by towering mountains. There is a wide variety to choose from; and that the sport is of the very best is annually attested by the experiences of thousands of the sons of Walton who hie them away for a try at the big fellows. They generally come back with what they went for, and some memories, too, that are enlivened with bright lights that are prone to linger long in the consciousness; on the other hand, it is doubtful if such memories ever pass out of one's hoard of recollections.

It is the pride of California to know that it has a native trout that has gone down to fame, and has taken up its home in practically every quarter of the world. Just how many of the people of the Sunny State are aware of this I do not know, but that brilliant clan, the California league of fly-rod men, are in understanding of it. The fish I have reference to is the rainbow trout (*Salmo irideus*), the most noble finny fighter that ever seized an artificial fly and made a leaping, dazzling flight through the waters. In the Eastern section of the country men speak volumes about the speckled brook trout, though each and every one of them end up, at some time or another, by telling of the fight that the rainbow trout puts up when captured. As an introduction into other waters, the native Californian, rainbow trout, has proven himself well able to take care of himself and to perpetuate his kind for the benefit of anglers. The rainbow trout is now found in the waters of the British Isles, in France, Germany and Russia. Exceptionally good rainbow trout fishing is to be had in the many rivers of South Africa. Anglers have written enthusiastically of fishing for *Salmo irideus* in the streams of New Zealand. In our own country the rainbow trout has had a wide distribution. Knee deep in the waters of Michigan and Wisconsin streams I have played this fighter—the pride of California; reared at the foot of the snow-capped mountains, in the heart of the Sierras. In the rage that swept the Eastern States over speckled brook trout fishing, a condition has arisen where practically every stream has been sapped of its spotted beauties. Where to turn for a replenisher? The rainbow trout is always the happy solution. There is not a properly-fitted trout stream that will not do for the rainbow trout. It grows fast. It fights well.

But it seems that only in the shadow of their beloved mountain home (as in the Sierras) do the rainbow trout give a befitting example of their sprightly dash and pugnaciousness. One who has tested the fighting leap and flight of a rainbow trout, in its own particular native waters, in the mountains, and has tested a fish of the same species in Eastern waters at once knows the difference. Still flowing, often quite warm, and often discolored streams (which the rainbow trout has been introduced into in the East) produce a slow-moving fish with little fight in him. Such fish speedily degenerate into gluttons, and keep themselves in the pools. Many of these hulking fellows finally get to hugging the bottom and rarely come to the surface to take a fly.

How different the mountain rainbow! Unused to warm water, like the brook trout, he demands the sweet, cold water. By reason of the swiftness of the mountain stream he has a vigorous "kick" to his tail. His fins are superlatively strong for breasting those crystal currents. When he takes your artificial fly he does not lazily rise to the surface to suck it in, but snaps it. A moment later he will turn a double or triple somersault and the fight is on. 'Ware of that light tackle! He is a match for you. Back and forth he will race from one edge of the stream to the other. He is cunning, too, and knows every log and obstruction in the stream. He will (if you do not watch out) snag your leader on a convenient boulder and there will be nothing left but the fragrant memory of what might have been. The mountain rainbow is a high flyer, with the guarantee of gameness linked with his name. It recalls the brilliant words of Charles Frederick Holder: "How that rainbow came at me; how it went repeatedly into the air; how I nearly fell overboard, are matters of personal history, and need not be dwelt upon; but for the first few seconds that living rainbow, which went pirouetting over the little river on its tail, throwing impossible aerial swings and leaps, filled a space in my imagination. Again and again the rainbow leaped, a silvery radiance flashing in the sunlight, dropping back to dash about the boat, to come in with a rush, faster than I could reel. * * *

"You have, perhaps, never seen a big rainbow fresh from the icy pools of its choice. Know, then, that this fish, this seven-pounder which I held upon the scales, was a thing of beauty, a joy forever beyond dispute. Its back was well sprinkled with ocelot-like black spots; the color a deep green, the lower surface silver, while over all seemed drawn a filmy gauze of old-rose fabric, of inexpressible delicacy and beauty, which was intensified along the median line in a band of pink and rose and other tints that produced all the colors of the rainbow, for truth, and gave this radiant creature rank among the birds of brilliant plumage."

Holder wrote of the large rainbow trout to be taken in the lakes and streams of northern California and southern Oregon. How skillful was this great California angling writer in telling the beauty of fishes, and the fascination in taking them? No one has equalled his efforts at word painting with black upon white.

When one speaks of rainbow trout in California one instinctively thinks of the Kern River, which finds its birth in the high Sierras. The waters from Mount Whitney pour into that beautiful stream, "a great, clear, green, swift stream, among the granite rocks, its waters slipping along like oil; a river with rippling shallows and deep, cold eddies, the perfect home of the trout." The Kern River is famed among anglers the world over. When anglers meet it is always: "Have you ever fished the Kern, of California?" If you have fished the Kern you are the center of a curious throng of interested listeners. Especially does the Kern River interest anglers in that some of the tributaries from Mount Whitney contain a trout that is one of the gentle wonders of this planet. I refer to the so-called golden trout. Professor Gilbert brought out the first specimens of this fish for identification. David Starr Jordan designated the fish *Salmo gilberti*. That was some twenty years ago. The fish was brought from Soda Springs on the

south fork of the Kern River. Later the isolated golden trout of Volcano Creek were designated as a species apart from the others, the scientific term being given them (*Salmo agua-bonita*).* This name was derived from the waterfall that separates the Volcano Creek from the rest of the world—that is, as far as coming and going concerns this trout. There are scientifically, three species of the so-called golden trout in the Mount Whitney waters; overcast in gold, the fins tinted in the purest orange with a nicely brushed-in orange colored stripe along the median line. The golden trout are an off-shoot of the rainbow trout; merely that changed environments have wrought a subtle transformation in their coloration, for the pigment cells of a trout are very sensitive to taking on a new coloration. If a stream bottom be of sand and gravel, and very bright, the fish attains to a silvery coloration. The golden trout owe their coloration to the color of the bottom of the stream they live in. "The rocks over which these streams flow," says Jordan, "are of bright granite and quartzite, gray and red. It is supposed that the color is protective, for the fish are colored like the bottom. To a bird looking into the stream, the deception is perfect. It is supposed (though no one knows) that the colors have been attained through natural selection. The redder the fish, the better its chance to escape the fishhawk and eagle. If this is not the cause of the color, no one can guess any other, and to escape its enemies through resemblance to natural objects is not a trait of the fish alone, but of hundreds of other creatures in these and other mountains. But whatever the cause, nothing in nature is more beautiful or more graceful than a golden trout, alive in these clear, icy, sun-lit waters."

The golden trout are trout of the high altitudes. Such trout rarely grow to length and breadth and weight. One rarely catches a true golden trout much over three-quarters of a pound in weight. They rarely go over twelve inches in length; a ten-incher may be taken as a large one. They attain to maturity at a length of about eight inches. Sadly, they are unwise, being so far removed from man, and they take the fly with a dash and at the first cast that leads many a fish hog to catch ten times more than he should. Quieter stretches of water (as where it flows through the meadows) provide good fishing. The trout angler will find joy in taking a very few of these exceptional fishes and enjoy the thought that he is in a region that, for beauty, it is hard to equal.

Unknown to many, the size of the stream, the river or the lake that a rainbow trout is found in has its effect upon the size of the fish. The reason of this is two-fold: first, the size of the stream; second, the smaller amount of food that it produces. It is for this reason that the rainbow trout often mature when they are six inches in length, in the streams of the high altitudes. They will ravenously seize the artificial fly, believing it food, for there is a scarcity of it, and therefore its attractiveness is instantaneous. In the slightly larger streams the rainbow trout attain to weights of about two or three pounds. In still deeper streams and large pools four-pounders are not uncommon. The Kern, the Kings and the Merced rivers are representative rainbow

*It was later learned that the specimens to which Dr. Jordan gave the name *Salmo agua-bonita* really came from Cottonwood Creek, into which they had been introduced from South Fork of Kern River, and that the trout of Volcano Creek is a very different species, which Dr. Evermann named *Salmo rooseveltl*. See pages 124-125.

streams. In the lakes (as in Kern Lake) the rainbow trout reaches to a weight of eight pounds. In the Klamath Lakes rainbow trout have been taken as high as twenty-five pounds in weight. The ocean-running rainbows are large; they are salmon-like fellows. They feed heavily in the ocean and thus attain often gigantic weights. In the ocean their beautiful fresh-water coloration fades and they become silvery in coloration. They generally come up to the coast rivers in the month of March to spawn.

Summer on the California trout streams is one of joy unending and success in due measure. Nevertheless, it is strange what a falling off occurs in the number of anglers who visit the streams in the latter part of July and August. Opening days are always attended by outward moving delegations of anglers; and the streams are thickly peopled. Later on, however, they dwindle down to twos and threes—and the streams are left to themselves. A certain number of these sons of Walton know that the best fishing occurs when the heats of summer lower on the earth, for it is then the mountain waters yield up their fairest specimens. Those secluded pools are then veritable treasure-places and bear a careful looking into; it takes skill and the correct lure, but the wise angler is never wanting in fitting perfectly into the situation. Live bait, spinners and artificial flies are used. The live-bait man knows that the grasshopper is a telling lure what time the July sun is gilding the heavens and is never to be found near to the waters then without a box of them. How to use them on the hook without impaling them? Simply procure some of the smallest druggist rubber snaps. Take a sufficient number of turns of the rubber around the hook, bend and then insert the hopper in the loop. Helgramite are attached to the hook in the same manner and they will still be as alive as ever. The druggist rubber snap is a bait-saver, and no mistake. One may catch fifty trout (if it so be) on a helgramite, attached to the hook with a snap, and at the end of the day's fishing it will be as active as ever. The larvæs of the Dobson fly (which is the helgramite) are only too well known to the live-bait fisher. They are those wicked-looking creatures one finds in the streams upon turning up stones. They have a series of pincers on each side, though they are more savage in appearance than in actual combat. It has been said that when all else in the line of bait fails, the helgramite, the grasshopper and the angleworm will win.

And there is method in the skillful use of the angleworm, too. In fact there is an art, in itself, to "working for trout," as it is called. Your chuck-and-chance-it, live-bait fisherman will hook on a great gob of worms; will start it at the head of a pool and will let it tumble, haphazard down with the current, rolling over the bottom of the stream. Some rainbows may see it, and take it, no doubt, but not the fish you are looking for. The true sportsmanlike method of worming for trout consists in connecting a bare hook to a spinner—a No. 1 or 2 spinner will do nicely. To this bare hook the worm is attached so that it will trail in the water. Instead of driving the hook throughout the worm, it is hooked just under its skin. It requires some little art to cast this—in fact, it is not a cast at all, but is allowed to play out in the water. The spinner will whirl, throwing off a silvery ray, and the long, trailing worm will have a snaky, wavering motion in the water

that proves instantly attractive. Move this into some suspicious-looking mountain pool and if there is a large rainbow trout there he will be interested in sampling your offering, be it feeding time or no. It is hard, in the finny world, to refuse an angleworm that trails so subtly and enticingly in the water.

However, the safest and most certain method in using the angleworm for a lure goes as follows, and has never been known to fail at getting the fish that strikes: A No. 10 is slipped on to a leader and is tied to the leader one and one-half inches from the end of it. The hook should not stand out from the leader; rather the hook shank should lie along the leader. This done, a second hook is tied on to the leader at the end, to be the lead hook, the front hook, so to speak. Now the worm is connected to this affair, the head of the worm being attached to the back hook, while the front hook is worked into the body. To all appearances when this is moved in the water the worm is free; this is especially true if you are using an invisible leader, of which there is at least one on the market. When a fish strikes this worm he will hook up either to the first or the second hook on the leader, or both. There is hardly a chance here of nipping off the end of the worm for the simple reason that there is a hook in it.

It seems strange, but nevertheless a fact: Trout will strike freely and well, it seems, at all times, on the fore-fin of a trout. Simply upon capturing a trout sever one of the fore-fins and attach it to the hook. Some of the largest rainbow trout in the mountains will take the fin viciously when even the succulent grasshopper fails. This fact may be known to some anglers, but it is as one in ten. The same is true of a little white strip cut from the belly of one of your trout, about two inches long and one-half inch wide at the butt end. Attach this to the hook at its tip and play it to the current. If the current is strong, one will need to place several split-shots on the leader to sink it. Then let out line. Let it flow downstream. Seventy-five, one hundred, one hundred and fifty feet, perhaps. Down it goes, moving in and out of the pools. Suddenly a large fellow beside a boulder will seize it and the fun begins. These methods win when the fish are weak on surface feeding, and are closer to the bottom; and this often happens. Do not forget the fore-fin or the belly-fin of the trout as a lure. Many are not aware of it, but the artificial fly known as the Parmachenee Belle, was made in imitation of the belly-fin of a trout. Think of it; instead of imitating an insect (as many suppose it should) it is an imitation of the belly-fin of a trout. Could anything be more incongruous? Yet it was such a valuable hint that the inventor (a great angler) made a fly to represent it. The July and August angler in the mountain pools should give this his careful attention.

It has been said that there are times in July and August when the angler is not able to "rise" a fish; that the fish do not even seem to do any surface-feeding. Naturally, the best fishing goes on when the fish are rising to the top for insects, as when a hatch of insects is on and they are rising from the bottom of the stream. The higher one goes up in the mountains the fewer, it appears, become the true stream insects. The angler must needs use art in collaboration with some true study to make some appreciable catches. Mountain trout may be uncertain fellows. Having had poor luck (if any) with a small fly, he may

shift to a rather large fly (even a bass fly) and immediately rise a large fellow and make the best catch of the season. The trouble with the ill-luck of many anglers is that they give no time to experimentation. They place their luck with one variety or color of fly, or one size of fly, and remain at that, without trying anything else. There is another extreme to this in that many fly-fishermen are constantly changing flies and using one but five minutes before another shift is made. The result is that no fly is given a true tryout. Again there is a hint learned from experience: One cast well-judged and well-placed is worth ten indifferent casts that have been poorly placed. The difference is that the well-placed cast is the one that brings success; the poor casts, ill-judged, are so much waste of time. Study every nook and cranny of the stream you are to cast over. Don't make a cast till you have mentally made note of where a large fellow would in all likelihood happen to be. For instance, beside that large boulder there is a patch of still water. If you can make a cast so that your fly, or flies, will fall on the boulder you will craftily pull them off the boulder—and in the most natural manner they will fall to the still patch of water. Deceived, believing the artificial flies true insects, that large and dazzling rainbow will rise and take the offering. Or here is a semidark place under a sedgy bank. There is a still place there. A trout should be lurking in that nook. Or here is a log in the water. Try your bait or fly alongside of that, seeing to, always, that your fly falls first, not the line and leader first. Poor casting, I firmly believe, has only one result, that being: Ill luck!

During the fore part of the season a great number of anglers go out, but they are live-bait users almost entirely. The salmon-egg contingent, the dyed-in-the-wool fly-fisherman calls them—and the true fly-fisherman can be counted on to eschew the streams till the inimitable July and August days arrive. Then he goes happily forth into the mountain stillnesses.

There is a reason, too. The early fisherman had to contend with high and swift water which was mostly discolored. It was the using of live bait entirely, for the stream insects were not hatching, so that the trout could be deceived by artificial counterparts. Now, however, the winged life is abroad; the fly-fisherman is in his element. As the warmer days come on, the water in the lower reaches of the rivers disappears or becomes heated out, the fish gradually but surely make for the upper pools, and thence follow the fly-fishermen. It is riotous travel at times; the road is rough. Sometimes there are no roads and one makes his own paths at will. But there is a reward among the cools of the upper valleys and natural parks where Nature in all her untrimmed and majestic glory contrives to make California the true Arcadia of the disciple of Walton.

PARASITES WHICH AFFECT THE FOOD VALUE OF RABBITS.

By E. RALPH DE ONG, University of California.

A fringe of small, lead-colored bodies, the size of coarse shot, is frequently seen on the ears of the brush or cottontail rabbits. These are young ticks, the immature form of one of our common species, probably the wood tick (*Dermacentor occidentalis*). After hatching from the egg the young ticks wait in the grass for a passing rabbit or other animal, attach themselves and feed for three or four days, drop to the ground and molt (shed their old skins), then await another chance to feed.

The presence of these ticks has no effect on the rabbit except a slight loss of blood and a temporary annoyance, and as this tick has not been

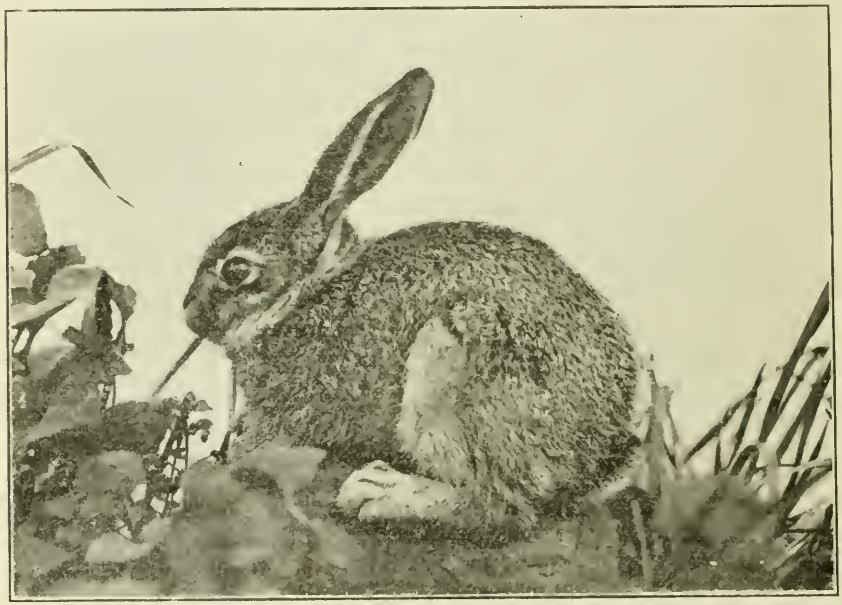

Fig. 48. A young blacktailed jackrabbit, an animal often discarded for food because of the presence of parasites. Photograph by J. Dixon. Neg. 290, Calif. Mus. Vert. Zool.

reported in California as a carrier of any disease it need not be considered as of any significance.

The species of fleas commonly found on rabbits in this state have not been reported as disease carriers so that the presence of these insects can also be disregarded.

One species of botfly (*Cuterebra* sp.) attacks rabbits very commonly. The larvae of this fly is almost black in the mature stage, about three-fourths of an inch long and covered with tiny spines. Brush rabbits taken in Sonoma County up to the last of July were commonly infested with this insect. After the first of August no larvae were found, they apparently coming to maturity at this time. They then leave the host and bury themselves in the ground, emerging the following year as flies. The larvae are found just beneath the skin along the back or breast.

The only outward indication of their presence is a slight enlargement at the affected point. No injury to the muscles was noted in any infested specimen, the body being apparently in a normal condition. Wounds of this kind may, however, become infected by bacteria or become infested with some of the flesh feeding flies and in this way produce large tumorous swellings. These latter attacks, when severe, may produce an emaciated condition of the animal which manifestly impairs the value of the carcass for food. But if the larvae are present on the body of the rabbit, without any outward or internal sign of disease there would seem no reason for discarding the same.

Rabbits are occasionally taken in this state which show the larval form of a common tapeworm (*Cœnurus serialis*) which, when eaten by the dog produces the adult tapeworm *Tœnia serialis*.[1] The infestation in the rabbit appears as a transparent, bladder-like swelling which may be as large as a hen's egg or larger and is of frequent occurrance in jackrabbits, often spoken of by hunters as "boils." Scattered about on the inner surface of this bladder will be seen white dots about half the size of a pinhead. These are the undeveloped heads of tapeworms, each one of which is capable of developing into a mature tapeworm if taken into the body of a carnivorous animal in a living condition. Hence an animal eating an uncooked rabbit infested with one of these bladder worms will develop a typical case of tapeworm. Thorough cooking will kill the larval form so that the meat can be fed to animals without danger. But the uncooked carcass or viscera should not be fed to animals.

One specimen of brush rabbit had two infestations: one originating in the thigh had grown so large as to displace the muscles, the second formed a large swelling on the surface of the breast. Any infestation of this kind should be regarded with suspicion and the carcass burned or buried deeply so as to be out of reach of all carnivorous animals.

Domestic rabbits and probably the wild form are subject to a disease called *coccidiosis* resulting from the attack of a sporozoa (*Coccidium oviforme*). The symptoms are snuffles, running at the nose and diarrhoea. The inner walls of the intestines show reddened patches with more or less ulceration. The liver is enlarged and the interior has many small round abscesses filled with pus; as the disease progresses the carcass becomes emaciated. Animals affected with this disease should be considered as unfit for food.

An ear mite (*Otodectes cygnatis*) is mentioned by Professor Herms as sometimes being abundant enough to cause serious disease or death to domestic rabbits.

[1]Determination by Professor W. B. Herms.

OUT FISHIN'.

By Edward A. Guest.

A feller isn't thinkin' mean—out fishin';
His thoughts are mostly good and clean—out fishin';
He doesn't knock his fellow men,
Or harbor any grudges then;
A feller's at his finest when—out fishin'.

The rich are comrades to the poor—out fishin';
All brothers of a common lure—out fishin';
The urchin with the pin and string
Can chum with millionaire an' king;
Vain pride is a forgotten thing—out fishin'.

A feller gets a chance to dream—out fishin';
He learns the beauties of a stream—out fishin';
An' he can wash his soul in air
That ain't foul with selfish care,
And relish plain an' simple fare—out fishin'.

A feller has no time for hate—out fishin';
He ain't eager to be great—out fishin';
He ain't thinkin' thoughts of self,
Or goods stacked high upon a shelf,
But he's always just himself—out fishin'.

A feller's glad to be a friend—out fishin';
A helping hand he'll always lend—out fishin';
The brotherhood of rod an' line,
An' sky an' stream is always fine;
Men come real close to God's design—out fishin'

A feller isn't plottin' schemes—out fishin';
He's only busy with his dreams—out fishin';
His livery's a coat of tan;
His creed's to do the best he can;
A feller's always mostly man—out fishin'.

CALIFORNIA FISH AND GAME

A publication devoted to the conservation of wild life and published quarterly by the California State Fish and Game Commission.

Sent free to citizens of the State of California. Offered in exchange for ornithological, mammological and similar periodicals.

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All material for publication should be sent to H. C. Bryant, Museum of Vertebrate Zoology, Berkeley, Cal.

July 15, 1919.

"There is nothing that attracts human nature more powerfully than the sport of tempting the unknown with a fishing line."—Henry Van Dyke.

VINDICATION.

Periodically, the state Fish and Game Commission is attacked by members of the legislature. Any state commission which has to do with the enforcement of law is subject to such attacks. In 1911 an investigation was ordered by the assembly. The investigating committee, however, gave a very favorable report as to the activities of the Commission. The 1919 assembly began an inquiry which also resulted in complete vindication for the Commission. We hope to publish in the next number the full report of the Committee on Governmental Efficiency and Economy to which a resolution by Assemblyman Eden was referred. While it would seem that the resolution was actuated by spite, the result has been very favorable to the Fish and Game Commission, for it has shown the people exactly where the Commission stands and has widely advertised the accomplishments of the past few years.

NATURE STUDY LIBRARIES TO BE FURNISHED SUMMER RESORTS.

Compact nature study libraries will be placed at those Tahoe resorts which are selected for the educational work of the Fish and Game Commission the coming summer. The libraries will include books on birds, mammals, wild flowers, trees and kindred subjects. Donated to the state by the California Nature Study League, they will be deposited with the Fish and Game Commission to be thus utilized in the commission's educational work. These libraries will be annually loaned to summer resorts in the future and probably represent only the beginning of a work which will eventually cover all the summer resorts of California. They are intended for use at that time when people, being on a vacation, are most receptive to studying intimately the miracles of nature. In ways such as this the Commission is applying the motto: "Conservation through education."

THE 1918 CATCH OF FISH.

Among the reports of this issue of CALIFORNIA FISH AND GAME is a complete statement of the fresh fish taken in California during the year 1918. In this statement there is included a record of fish taken in Mexican waters and brought into California through San Diego and San Pedro, but this is not included in the total for California.

The total catch of all varieties of fish in California for 1918 was 250,218,041 pounds. Compared with the 201,575,953 taken in 1917, this shows an increase of 48,642,088 pounds, or a trifle over 24 per cent. For a ready comparison of catches of the more important fish for 1917 and 1918, the following table is given:

	1917	1918
Albacore	30,556,243	7,263,895
Barracuda	2,965,368	3,885,691
Bonito	889,896	2,264,164
Halibut	3,585,666	2,837,987
Herring	7,435,997	7,938,280
Mackerel	3,345,563	4,005,906
Rock fish	6,255,380	6,281,425
Sole	8,728,429	7,027,767
Salmon	11,007,442	13,026,076
Sand dabs	2,631,862	1,751,609
Striped bass	1,095,856	1,407,841
Shad (buck and roe)	5,616,110	2,383,635
Sardine	104,103,331	157,652,811
Skipjack	———	3,023,847
Tuna	———	6,240,971
Yellowtail	2,887,413	11,658,259

The figure for the albacore catch of 1917 includes the bluefin and yellowfin tuna taken. In 1918 the albacore catch was very short and as bluefin and yellowfin tuna were more plentiful, a much larger number were taken and were for the first time separated from the albacore under the name "tuna." The tuna and albacore catch combined in 1918 was less than half the albacore catch of the previous year.

The sardine catch shows a phenomenal increase although southern California had a light run of sardines during the latter

Fig. 49. Four new fish hatcheries. Upper left, Ft. Seward Hatchery, Ft. Seward, California; upper right, Kaweah Experimental Hatchery, Kaweah River, Fresno County, Cal.; lower left, Clear Creek Hatchery, Westwood, Lassen County, Cal.; lower right, Domingo Springs Hatchery, Domingo Springs, Plumas County, Cal.

part of 1918. Shad, halibut, sole and sand dab all show a decreased catch during 1918, while bonito, barracuda, mackerel, salmon, striped bass, skipjack and yellowtail all show an increased catch. Although the catch of salmon on Monterey Bay was less, much heavier catches were made at Drakes Bay Fort Bragg and on the lower Sacramento River, which brought the total catch for 1918 to over two million pounds more than that of the year 1917. There was no great fluctuation in the catch of other species.

There was a decrease of 41,177 dozen in the catch of crabs and of 41,943 pounds in the catch of crawfish, while the catch of shrimps shows an increase of 117,174 pounds ove the year 1917. The mollusks do not show any great changes over previous years.

The Department of Commercial Fisheries is making every effort to secure and complete accurate statistics of the catches of all fish and it can readily be seen that a comparison of yearly catches for a number of years will aid in determining whether any certain species is being overfished and depleted, or whether it is becoming more abundant.—N. B. S.

MAINTAIN A SUPPLY!

It can not be expected that wild life resources, if left to themselves, will continue to yield food and sport indefinitely. The reason, of course, is to be found in the encroachment of civilized man, which not only means increased destruction, but a diminution of food supply and nesting sites. Under the artificial conditions now fostered a constant supply can be maintained only through carefully planned protection and propagation. By looking over the attainments of the Commission whose function is to perpetuate fish and game, we are assured that the financial outlay has been more than justified.

RAINBOW TROUT ACCLIMATIZED IN ARGENTINA.

In 1903 at the request of the government of Argentina the United States Bureau of Fisheries donated the eggs of

several varieties of fish to the southern republic. A letter recently received by the Bureau states that thousands of Eastern brook trout are now being caught annually, that some measure 19 inches, and have a weight of 10 pounds. In the mountain range of Aconquija in 27° south latitude and in the Patagonian region as far south as 52° latitude, the rainbow trout is doing well.

A COLLEGE OF FISHERIES ESTABLISHED.

An event of great importance to those interested in the fisheries of the United States, and especially so to those of the Pacific coast, has been the recent establishment of a College of Fisheries in connection with the University of Washington at Seattle. The need for such a college has been felt for some time, and Dr. Suzzallo, the able and progressive head of the university, is to be congratulated upon his action in this matter.

The commercial fisheries of the Pacific coast are of great importance to its welfare, how much so being plainly indicated when it is stated that Washington, Alaska, Oregon, California and Hawaii produced last year approximately 1,600,000,000 pounds of raw fishery products valued to the fishermen at about $25,000,000. Seven-eighths of the world's pack of canned salmon is made on the coast, while tuna, sardines, clams, crabs, shrimp, mackerel, abalone, etc., are canned in large quantities and shipped to all quarters of the globe. Immense quantities of frozen, fresh, pickled, salted and smoked fishery products are also prepared and shipped. When so prepared the value of the fishery products of this coast alone is increased to over $100,000,000; the investment in plants, vessels, boats, fishing gear, etc., on this coast amounts to about $95,000,000, while over 75,000 persons are employed in fishing and preparing the above products for market.

The production of raw fishery products elsewhere in the United States amounts annually to approximately 2,250,000,000 pounds, valued, to the fishermen, at approximately $60,000,000. When prepared for market these products would probably be worth approximately $120,000,000.

The College of Fisheries just established by the university enjoys the distinction of being the only one of any consequence in the world outside of Japan. In the latter country the Imperial Fisheries Institute at Tokio is a government institution and has been in existence since 1897. Since then subsidiary schools have been established in various provinces of Japan.

Seattle is an ideal location for such a college, as within its corporate limits, or in territory immediately adjacent, are to be found in active operation practically every style of plant used in turning the raw fishery products into all forms of manufactured articles both for food and for use in the arts and sciences; while the great salmon, halibut, cod, and herring fleets operating in Alaska waters have their headquarters mainly in this city, outfitting here and bringing back the products for shipment to the four corners of the world.

The college offers four year courses in fisheries technology and fish culture. The fisheries technology courses will train men

TROUT FRY DISTRIBUTED IN STREAMS AND LAKES OF CALIFORNIA DURING PAST THREE YEARS.

	1916	1917	1918	Total
Rainbow	3,399,920	5,223,500	5,680,500	14,303,920
Eastern brook	2,068,500	1,617,500	2,294,500	5,980,500
Loch Leven	1,620,000	1,468,000	1,633,000	4,721,000
Black spotted	3,835,270	3,836,000	1,059,500	8,730,770
Steelhead	5,213,170	6,699,420	4,483,000	16,395,590
German brown	77,300			77,300
Golden trout			384,000	384,000
Totals	16,214,160	18,844,420	15,534,500	50,593,080

for various lines of work in industrial plants. Owing to the immensity of the business, as noted above, there is always a demand for trained men in the salmon and other canneries cold storage plants, smokehouses, and fertilizer and oil plants. Every effort will be made to make the courses as practical as possible, and students will make visits to the plants whenever possible so they may obtain first-hand information as to the methods in vogue. They will also receive training in bacteriology and chemistry, and thus will be fitted for work in marine biological laboratories, and in chemical and bacteriological laboratories, specializing in fishery products.

The practice of fish culture is becoming a very important one, and the demand for trained men is bound to increase. Students at the college will not only have the benefit of its instruction and equipment, but can also obtain an abundance of practical experience along all lines of fish culture at the many federal and state hatcheries scattered throughout the state of Washington.

Pond culture, or the farming of our inland waters, will some day be an important industry, as there are many thousands of small lakes, ponds, streams, and marshy spots which would be utilized in this work, and acre for acre produce greater returns than a similar area of land devoted to agriculture.

The shellfish industry of the Pacific coast has not thrived for some years, due largely to faulty methods, and it is hoped that with more modern methods taught there may be a revival of this industry, which ought today to be one of the most important on the coast.

It is hoped in the near future to offer short courses in practical fishery subjects during the winter months when fishing operations are quite generally suspended, these courses to be open to those now engaged in the fisheries and others who desire knowledge along special lines and do not have the time nor desire to take the full courses.

As the university is a state institution, an especially important part of the work of the College of Fisheries will be in rendering assistance and advice whenever called upon by the state authorities, and also to aid the commercial fishermen not only of the state but of the nation in solving the many problems which beset them, and to aid in the conservation and perpetuation of our wonderful fishery resources. Research work along the lines of utilization of hitherto neglected species, and of waste products, will be carried on and it is hoped will result in materially increasing the wealth of the state and nation.

It had originally been planned to open the college at the beginning of the fall term in October, but so many of our returning soldiers expressed a desire to take up the work at once that hurried preparations were made and the college opened for the spring quarter beginning March 31, last.—JOHN N. COBB.

MANY LIONS KILLED.

Bounty reports for the first three months in 1919 show that an unusually large number of mountain lions have been killed in the state. The exact reason for this kill is not apparent, but doubtless the hiring of a man to give all of his time to the destruction of predatory mammals has had some effect in stimulating the destruction of the famous deer killer. The totals for the three months are as follows:

January.

21 males	at $20.00	$420 00
24 females	at $30.00	720 00
		$1140 00

February.

10 males	at $20.00	$200 00
16 females	at $30.00	480 00
		$680 00

March.

22 males	at $20.00	$440 00
18 females	at $30.00	540 00
		$980 00

AIRPLANES TO LOCATE FISH.

Still another use for the airplane is to be found in the recent experiments carried on along the Atlantic coast where a duly qualified observer has been making flights to locate schools of fish. Information so obtained is telegraphed to the fishing interests.

FISHERY PRODUCTS LABORATORY ESTABLISHED.

The increased importance of the California fisheries has led the United States Bureau of Fisheries to establish an experimental laboratory at San Pedro. The laboratory is now completed and the equipment installed. A corps of three scientists will experiment on methods of preserving fish and otherwise render service to those engaged in canning, drying or salting fish.

THE OWNERSHIP OF WILD LIFE.

Wild life is the property of all the people. No one attempts to deny this, and least of all the game violator. From his point of view it is not only the property of all the people, but it is more particularly the property of him who can get it. The more remote the locality where the law is violated, the more deeply rooted is the idea that the game is there to be taken, regardless of law, and without much feeling of moral obliquity. The violator has a strange feeling that some sort of justification is on his side, though the law may be on the other. The point of view is that of early colonial times, before the state had reason to assert its ownership—when, indeed, game was the property of anyone who could shoot straight enough. It is the point of view of an extreme individualist.

Game is still the property of everyone. But, whereas originally the people placed no restrictions upon the use of that property, they have now thrown about it safeguards that are vital for its continued existence. Every citizen has a vested interest in every individual bird animal and fish, and is defrauded if the game is taken in any way contrary to the established rules. The point of view of the man who respects the law, and insists upon respect for it in others, is that of collective ownership. His individual right to take game is dependent upon consent to do so from others.

The feeling of collective ownership is still only partly developed. The tendency to wink at violations still decreases as the sense of common ownership of wild life is strengthened.—*The Conservationist*, Nov. 1918, p. 173.

OUR FUR RESOURCES.

More and more we are discovering that the annual take of furs in California is considerable and that the money received by the trappers amounts to a large sum. Most of the furs are shipped to Eastern markets, but recently it has come to our notice that many furs are utilized by the trappers themselves. The books of the Eberhard Tanning Company of Santa Clara showed that during 1918 the following skins were tanned by them: 11 bear, 7 lion, 488 deer, 128 coyote, 86 raccoon, 12 badger, 176 fox, 15 opossum, 95 skunk, 121 wildcat, 429 rabbit, 53 tree squirrel, 14 mole.

A canvass of the different tanneries would doubtless furnish some valuable evidence as to what proportion of furs are used for home consumption.—I. L. Koppel.

BLACK BASS IS NOT A TRUE BASS.

Some of our readers have perhaps wondered why they did not find some mention of the black bass in the article entitled "Bass and Bass-like Fishes" which appeared in the April number. The primary reason is that the black bass is an introduced fish in our state and furthermore, this fish is more closely related to the sunfishes than to the true basses.

FACTS OF CURRENT INTEREST.

J. C. Bruce, the state lion hunter, has been at work in and around the McCloud River Game Refuge, District 1E. In this locality he secured three lions. This makes a total of 15 since January 1, together with 6 wildcats. Mr. Bruce started operations in Monterey County during May.

The past year brought splendid returns to the fur trapper. In several instances trappers received as high as $20 for coyotes, $8 for wildcats, and $2.50 for muskrats.

The Fish and Game Commission will install a permanent exhibit in the new building at the State Fair Grounds in Sacramento. The whole north alcove will be used to display the fish and game of the state and the activities initiated to conserve it.

Motion pictures showing the commercial fisheries of the state are being secured for use in educational and publicity work.

Far more definite research work on fish and game is now being carried on by the Commission than has been undertaken heretofore. Professor J. O. Snyder of Leland Stanford Junior University has been secured to undertake a scientific investigation of the quinnat salmon.

A study of the furbearers and the furbearing resources of the state is being undertaken by the Commission.

One haul of a trawl net made recently off the coast of southern California netted a ton of fish of seven different varieties.

Sportsmen convinced that the deer season has opened too early in southern California succeeded in having the law changed by the Legislature to provide for a September 15 opening, 15 days later than formerly.

Applications have been received requesting the setting aside of three different areas as state game reservations. An area of 25,000 acres, one of 30,000 and one of 20,000, are situated in Santa Barbara and Ventura counties.

Progress is being made on the attempt to negotiate treaties with the Spanish-American republics for the protection of migratory birds. The matter has been referred to the Department of Agriculture that appropriate conventions may be drafted. The state department has promised to act as soon as these drafts are received.

Paladini, the wholesale fisherman of San Francisco, was recently arrested for trawling within the three mile limit. He deposited $250 cash bail for his appearance before Judge De La Montanya at San Rafael. As Mr. Paladini did not appear, his bail was declared forfeited and a bench warrant was issued and given to Constable Crane to serve.

HATCHERY NOTES.

W. H. SHEBLEY, Editor.

BROOKDALE HATCHERY.

The take of eggs at the Scott Creek station will amount to approximately 1,700,000, of which 1,000,000 will be hatched at the Brookdale Hatchery for distribution in the streams in that section of the state. Shipments of eggs have been made to Wawona, Mt. Shasta and Mt. Whitney hatcheries, from which stations they will be given general distribution in suitable streams.

SNOW MOUNTAIN STATION.

The take of eggs at Snow Mountain Station, on the Eel River, was much greater than that at Brookdale, and will amount to probably 4,500,000. Of the eggs hatched at Snow Mountain 200,000 are to be planted in the upper reaches of the Eel River near the station, and the balance of the eggs have been shipped to Ukiah, Yosemite, Fort Seward, Mt. Whitney, Domingo Springs, Mt. Shasta, Kaweah and San Mateo hatcheries. From these stations the resulting steelhead trout fry will be given an extensive distribution under the arrangements made for carrying on this season's operations.

MT. TALLAC HATCHERY.

The Mt. Tallac Hatchery was opened for operations during the latter part of March, and the work is progressing very nicely. To date there have been nearly 2,000,000 black-spotted trout eggs taken and we expect to reach the 3,000,000 mark before the end of the season.

FALL CREEK HATCHERY.

The rainbow egg-collecting stations on the Klamath River were opened for operations during the month of February. Racks and traps were installed in Cottonwood Creek, near Hornbrook, and in Camp, Bogus and Fall creeks; and 1,750,000 rainbow trout eggs were taken at the four stations. A portion of the eggs were immediately shipped to Mt. Shasta Hatchery to be eyed, and the balance were placed in troughs at the new Fall Creek Hatchery, where they will be eyed for shipment to stations in other parts of the state. We have also arranged to hatch nearly a half million rainbow eggs at the Fall Creek Hatchery for distribution in the Klamath River this season. A million quinnat salmon eggs

Fig. 50. Fall Creek Hatchery. A fine modern hatchery built by the California-Oregon Power Company in lieu of a fishway over the Copco Dam. Photograph by L. J. Stinnett.

have also been hatched at the Fall Creek Hatchery and the resulting fry will be distributed in the Klamath River. Shipments of rainbow eggs will be made from Fall Creek Hatchery to Ft. Seward, Mt. Shasta and Yosemite hatcheries, from which stations they will be given the usual distribution.

BEAR LAKE HATCHERY.

Fish cultural operations were commenced at the North Creek egg collecting station during the latter part of March and racks were put in both North Creek and Metcalf Creek. The season has been a very favorable one, and while the run is still on, we believe that the take of rainbow trout eggs at this station will amount to approximately 4,500,000. Arrangements are being made to hatch and distribute 750,000 rainbow fry from the North Creek Hatchery, and a like number will be sent to the Bear Lake Hatchery, located at Green Spot Springs, from which station they will be distributed in Big Bear Lake and streams of San Bernardino County later in the season. Arrangements are being made to ship eyed eggs from the North Creek station to Mt. Whitney, Mt. Shasta, Yosemite, Kaweah and Wawona hatcheries.

ALMANOR HATCHERY.

Almanor Hatchery was opened for operations during the early part of March, and during the fore part of the season there was a good run of rainbow trout. However, it became necessary for the Great Western Power Company to run a big head of water through the Almanor spillway on account of the rapidly melting snow, and this prevented the biggest part of the run of rainbow trout from reaching our racks. However, we will probably receive between 300,000 and 400,000 eggs as the result of the season's work.

DOMINGO SPRINGS HATCHERY.

Domingo Springs Hatchery was opened the latter part of March and at the present time the run of rainbow trout in Rice Creek is on. Very few eggs have been taken to date, but the season promises to be a very favorable one.

CLEAR CREEK HATCHERY.

Clear Creek Hatchery will be opened up during the latter part of May and rainbow trout eggs will be shipped to this station from Almanor and Domingo Springs hatcheries. The resulting fry will be distributed in streams in the vicinity of Westwood and other portions of Lassen and Plumas counties.

MT. SHASTA HATCHERY.

The take of Loch Leven and German brown trout eggs was very successful. More Loch Leven trout fry will be distributed from Mt. Shasta Hatchery during the coming season than ever before. The German brown trout eggs taken are from stock held in the ponds at Sisson Hatchery resulting from eggs received from the Minnesota Fish and Game Commission three years ago. These will be the first German brown trout fry distributed in California for a number of years. The take of Eastern brook eggs was less than usual, and we will have only approximately 1,000,000 fry of this species for distribution during the coming season. Rainbow trout eggs from the Klamath River stations, Domingo Springs and North Creek, and steelhead eggs from Brookdale and Snow Mountain stations have been shipped to the Mt. Shasta Hatchery and the same will be hatched and reared for distribution in streams.

MT. WHITNEY HATCHERY.

Rainbow, Loch Leven, Eastern brook, black-spotted and steelhead eggs have been shipped to Mt. Whitney Hatchery from different stations in the state, and the resulting fry will be given wide distribution in the streams of southern California during the coming season. During the coming month we expect to open up Cottonwood Lake station, and if results are as satisfactory as during the past season we should obtain a half million or more golden trout eggs. These would be immediately transported to Mt. Whitney Hatchery and hatched for distribution in streams and lakes of the state.

WAWONA HATCHERY.

Wawona Hatchery was opened shortly after the first of May and rainbow and steelhead eggs are being forwarded from other stations. The resulting fry will be given the usual distribution in that section.

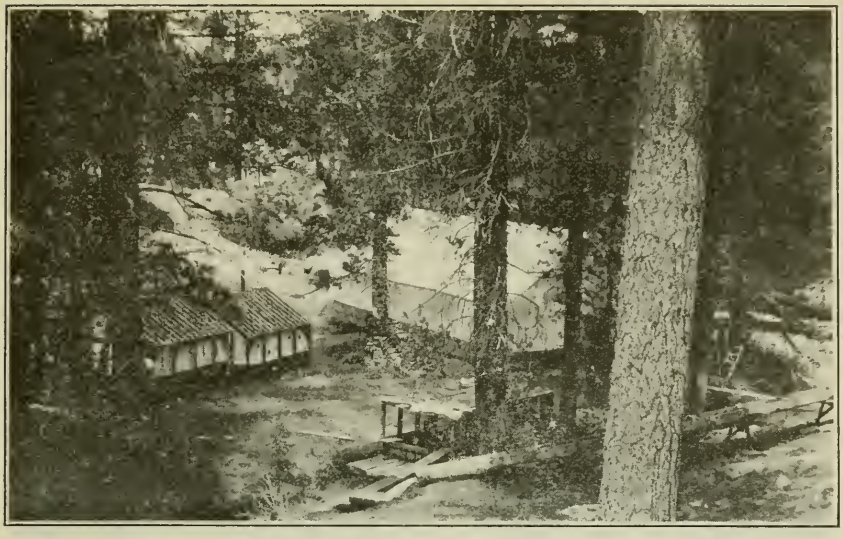

Fig. 51. Bear Lake Hatchery, San Bernardino County, California. The output of this hatchery stocks most of the streams of southern California. Photograph by Berry.

EXPERIMENTAL HATCHERIES.

A hatchery has been established in the Yosemite Valley at a site selected for the erection of a permanent hatchery, if the results of this season's operations are satisfactory. Before erecting a permanent hatchery in this section we deemed it advisable to determine by practical experiments if conditions were favorable for fish cultural operations. Rainbow, steelhead and black-spotted trout eggs will be shipped to the station and if the experiments are successful the resulting fry will be distributed in streams and lakes of the Yosemite Valley.

An experimental hatchery to determine the suitability of the waters of the Kaweah River for hatchery purposes has been established on the Kaweah River, near the town of Hammond, Tulare County. Rainbow, steelhead and black-spotted eggs have been shipped to this station, and if the resulting fry survive they will be distributed in the waters tributary to the Kaweah River, Tulare County.

NEW EXPERIMENT ON HATCHING SALMON ARTIFICIALLY.

The California Fish and Game Commission is trying out a series of experiments with trout eggs, to determine whether or not salmon can economically and scientifically be hatched and reared in cages placed in the beds of streams. These experiments will be conducted with eggs artificially fertilized and placed in the beds at different stages of development. Later in the season when salmon eggs are available the experiment will be continued by substituting the salmon for trout eggs. The idea is not a new one, as it was suggested by Professor Cloudsley Rutter in 1899. An experiment was made by Professor Rutter at that time, but on account of an accident the result was not conclusive. The Commission will now carry on experiments to determine whether any improvement in the propagation of salmon can be made along these lines. The experiments will be under the supervision of the fish experts of the Department of Fish Culture.

COMMERCIAL FISHERY NOTES.

N. B. Scofield, Editor.

FRESH FISH USED BY REDUCTION PLANTS AT SAN PEDRO.

During the last four months millions of pounds of fresh fish have been used in the manufacture of fish meal and fertilizer. The run of fish increased to such an extent in the first part of May that the reduction plants could not handle all the fish brought in. The fishermen, however, continued to bring in large catches of sardines regardless of any idea that they could be disposed of or handled by the reduction plants.

On April 30, the Minnie F brought in 58,995 pounds of barracuda, all of which could not even be used by the reduction plants.

The total amount of fish used to manufacture fish meal and fertilizer during the months of January, February, March and April, 1919, was as follows:

	Pounds.
Sardines	15,630,067
Barracuda	58,995
Rock cod	15,254
Kingfish	9,290
Halibut	4,400
Shark	2,712
Total	15,718,006

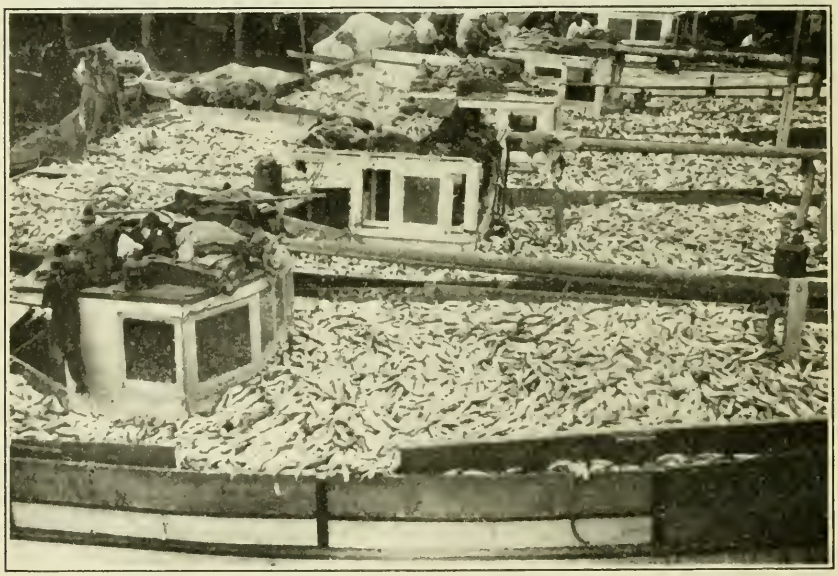

Fig. 52. Boatloads of sardines at San Pedro, May 6, 1919. All of this fish went to the reduction works to be made into fertilizer.

went to a reduction plant. On May 6 many sardine boats arrived loaded to full capacity with sardines which later went to reduction plants to be made into fish meal. One of these boats had 26 tons of sardines on board.

All the reduction plants combined have a capacity of about 1200 tons daily. The surplus was so great the city health department ordered 185 tons of sardines dumped out at sea in one day. The sardines were in such a bad condition they

Up to June 1, over 32,000,000 pounds of sardines had been utilized by the reduction works.—Earl M. Nielsen.

BETTER RECORDS OF CATCH NECESSARY.

In this issue of California Fish and Game will be found a statement of the canned, cured and manufactured fishery products of California for the year 1918. Although most of the packers have gladly furnished the Commission with the infor-

mation requested, considerable difficulty has been experienced in securing the record of packs made by a few firms throughout the state. Because of the lack of co-operation on the part of these few firms there are, no doubt, a number of discrepancies in the figures, not so much in the quantity as in the size and kind of container. Much of the salt fish is shown in barrels, although much of it may have been packed in smaller containers. The tuna pack reported by some firms includes individual firm and any statement or report made up and published, or furnished for publication, will be for the sole purpose of furthering and boosting a great California industry.

FIRST TUNA RECEIVED MAY 14.

The first yellow-finned tuna to reach any of the San Pedro and Long Beach canneries was received by the Van Camp Sea Food Company on May 14. The tender Undine brought approximately 13½

Fig. 53. Food fish made into fertilizer. Left, 26 tons of sardines; right 58,000 lbs. of barracuda.

their albacore pack, therefore the tuna pack shown is really more than the actual pack, while the albacore pack is short.

It will be the aim of the Commission to have the necessary blanks for the 1919 pack in the hands of all packers before the end of the year and it is hoped that all packers will co-operate with the Department of Commercial Fisheries of the Fish and Game Commission by filing a complete and accurate report of their operations for 1919 at the close of the year. This will enable the Commission to issue intelligent information on the California industry which should be of great value to all concerned. No information is given out regarding the pack of any

tons of yellow-finned tuna (*Thunnus macropterus*) from Lower California, where the above company is operating a cold storage barge and floating cannery in conjunction with its San Pedro plant.

NORTHERN BOATS JOIN FISHING FLEET.

Eleven purse seine boats have arrived at San Pedro harbor from Puget Sound points. These boats average from 60 to 65 feet in length and are equipped with heavy duty engines of from 45 to 85 horsepower. They were formerly engaged in salmon fishing, but plan to fish for tuna in southern California waters.

FISHERMEN RECEIVE 20 CENTS FOR FIRST TUNA.

The first tuna (*Thunnus thynnus*) to reach the local wholesale markets were brought in by the Peter Pan, a purse seine boat, on May 22. The total catch consisted of 3717 pounds and the fish averaged about 20 pounds each. The fishermen found an active market for their catch and received 20 cents per pound in the round.

FLOATING CANNERY BURNS.

The floating fish cannery, John G. North, which before its conversion was a sailing vessel, plying between Honolulu and San Francisco and other Pacific coast ports, was burned to the water's edge the morning of May 14 off Cape San Lucas on the coast of Lower California, according to word brought here by the fishing launch Rex. The John G. North was beached, all the crew reaching the shore safely. The loss was $50,000. The John G. North was operated by the Van Camp Sea Products Company, which has a plant at San Pedro.

NOTES FROM THE STATE FISHERIES LABORATORY.*

By Will F. Thompson and Elmer Higgins.

GOAT FISH TAKEN IN CALIFORNIA.

Several specimens of a rare and beautiful fish hitherto unknown in southern California waters were taken by the Albacore in March, 1919. They belong to the species *Upeneus dentatus*, of the family of surmullets. The fish are small, covered with large scales, and brilliantly marked with crimson and yellow bands. A pair of long fleshy barbels extending backward from the point of the chin makes the name of "goat fish" seem appropriate.

The species is recorded as "rare" on the coast of Mexico, and has been taken only at Cape San Lucas, La Paz and Tres Marias Islands at the far end of Lower California. The specimens taken by the Albacore are from Encinitas in 21 fathoms and from Long Beach in 5 fathoms.

This is another instance of a supposedly rare fish taken by new methods of fishing. The error in assuming that such rare fish are migrants from Mexican waters, where they are abundant, is apparent.—E. H.

SPINY LOBSTER LARVÆ.

An interesting addition to our knowledge of the life of the spiny lobster provided by the collections of the Albacore, is another series of larvæ in the phyllosome stage. These specimens are similar to the ones described and figured for the first time in the January number of California Fish and Game and although they were taken in February, six months later than the first series, they show about the same degree of development. About two dozen were taken in surface nets in the vicinity of Osborn bank, outer Santa Barbara passage.—E. H.

ATTEMPT TO REAR GRUNION.

Following the discovery of the remarkable spawning habits of the grunion or little smelt (*Leuresthes tenuis*), the story of which by Will F. Thompson has just been published as Fish Bulletin No. 3, an attempt was made in a small way to rear the young grunion through the larval stages to the adult condition. The young were hatched from eggs taken from the beach and were placed in jars of sea water. Running water was not used, but the water was changed daily and food was added daily from tow-net collections taken from the end of the Long Beach pier.

The larvæ lived thus at about room temperature with a maximum range of 10° F. for eleven days, when the last one died. The fish, of course, had not lost their larval character in this time, but interesting and valuable observations were made on their early development, and on their food and feeding habits. The experiment also yielded experience which will be valuable in the rearing of the young of other food fishes—an undertaking which may be carried out with adequate equipment in the new laboratory.—E. H.

*California State Fisheries Laboratory. Contribution No. 9.

LIFE HISTORY OF FLAT-FISH.

The investigation of the life histories of various flat-fishes of southern California has been progressing satisfactorily. Fourteen species of flat-fish, Pleuronectidæ and Soleidæ, have been taken to date by the bottom nets of the Albacore and notes on their distribution and movements recorded. Material for the study of the development of several species has also been taken and is awaiting careful study. Among this material is a complete series in the development of the sand dab from the youngest larva scarcely 5 mm. long to the spawning adult. Very young stages or partial series have also been taken of the big-mouthed flounder (*Hippoglossina stomata*), the sharp-ridged flounder or turbot (*Pleuronichthys verticalis*), the lemon sole (*Parophrys vetulus*), the long-finned flounder (*Xystreurys liolepis*), two species of sand dab (*Citharichthys stigmaeus* and *C. xanthostigma*), the diamond flounder (*Hysopsetta guttulata*), the tongue sole or San Diego sole (*Symphurus atricaudus*), and the California halibut (*Paralichthys californicus*).

The study of the California halibut has proceeded further than the rest and includes observations on the age and rate of growth, comparative sizes and numbers of the sexes, seasonal movements and migrations between banks, spawning period and egg-production, and early development.—E. H.

PORPOISE CAPTURED.

A unique experience in shooting big game was enjoyed by the naturalist aboard the Albacore when he killed a large porpoise, probably of the species *Lagenorhynchus obliquidens*, on April 19, 1919.

A school of about a dozen individuals was sighted about 35 miles west of Point Vicenti cruising on a course diagonal to that of the launch but at such speed that the launch was soon overtaken. The porpoises paused, circled about the boat several times, leaping and playing, and then resumed their original course. A lucky shot from a high powered rifle, however, caught one of the big fellows fairly in the body as he was leaping, and the rest vanished instantly. Death, which came after only a hundred yards or so of mad leaps and plunges, left the animal floating, head up, when he was easily gaffed and hauled on board with block and tackle.

The specimen was an adult male seven and one-half feet long and weighed about four hundred pounds. The skin was black on the back, head, and fins, white on the sides and belly and of satin smoothness without signs of bristles or hair as might have been expected, the porpoise being a mammal and not a fish. The skin was uniformly underlaid with a layer of dense hard blubber fully one inch in thickness, as was discovered when the animal was butchered.

Although the mouth is small and practicaly toothless, the porpoise is evidently a carnivorous animal, as the cardiac stomach contained six recently swallowed sardines of unusually large size—about one foot in length. In addition, the stomach contained about a pint of partially digested material and a quantity of fish scales.

The flesh of the porpoise is very tender, resembling beef in texture but is very dark in color. The flavor is delicate but quite different from any other meat. The body is so thick that the tenderloin supplied a great number of steaks and pot roasts of excellent quality except for the lack of streaks of fat so desirable in beef. The liver was large, closely resembling that of pork liver in flavor, and the heart baked *en casserole* was indistinguishable from that of beef. On the whole, the porpoise would be a valuable food animal if the public palate could be educated to the unusual.—E. H.

HALIBUT EATS LARGE ROCK.

The gray cods are famous all the world over for taking into their stomachs what the fishermen term "ballast," in the shape of stones of various sizes. These are considered necessary to enable the cod to maintain an even keel during the storms which rage on the surface of the sea above them. But it is not as generally known that the halibut (*Hippoglossus*) does the same thing. Due to the kindness of Dr. F. Kermode, director of the Provincial Museum at Victoria, B. C., I am able to reproduce the following letter from a prominent fisherman of Vancouver, B. C.:

"Mr. Walter White, for many years employed as a halibut fisherman on the vessels of this company, and latterly as a mate on our S. S. Kingsway, brought to the office this morning a rock weighing about two and a half pounds. White states that he personally took this rock from the stomach of a halibut weighing about 60 pounds, during August, 1918. The S. S Kingsway was fishing off Bonilla Island at the time, in thirty-five fathoms of water."

The explanation of this lies in the fact that the halibut are famous eaters of small things as well as large things, and they pick from the ground and from the rocks and kelp all sorts of animals, including sea anemones, clam siphons, worms, etc., and in the process of doing so they frequently take in things which were not intended to find a lodging in the stomach of a fish. It is due to reckless eating, not to foresight in taking in "ballast."—W. F. T.

YOUNG OF THE LADYFISH DISCOVERED.

In the April, 1919, issue of CALIFORNIA FISH AND GAME note was made of the abundance of the young of a supposedly rare species, the so-called "king of the salmon." We have another similar case to record here, the young of the ladyfish, *Albula vulpes*, having been taken in numbers in several hauls of a bottom net by our boat, the Albacore. The adult fish is classed as a rarity in the markets, though specimens are usually carefully saved, but the finding of many young indicates that the appearance of scarcity is rather a result of the failure of present modes of fishing to take the adults except as an accident.

The young here mentioned were taken three hundred yards off American avenue, in Long Beach, in from four to five and a half fathoms. They are approximately 7 centimeters (2¾ inches) in length, very transparent and delicate.—W. F. T.

CLAM INVESTIGATION.

The Fish and Game Commission has been fortunate enough to secure the services of Professor Frank W. Weymouth of Stanford University for a short period, beginning April 20 and ending in June. He will be remembered as having done much work on the edible crab (*Cancer magister*) of the Pacific coast. Professor Weymouth will initiate work on the clams of the coast which will prove of general interest, it is believed. The laboratory at Long Beach will be his headquarters.—W. F. T.

SHAD CAUGHT AT SEAL BEACH.

On the twenty-second of April of this year there was what might be termed a "run" of shad, *Alosa sapidissima*, several hundred pounds being brought in on that and succeeding days. They were taken in sardine nets, one of the hauls being taken off Seal Beach. All the fish were of large size.

The occurrence of the shad in the waters of southern California is rather unusual, although several times recorded as far south as San Diego. We are under obligations to Mr. Neilsen of the San Pedro office of the Commission for information concerning the run.—W. F. T.

ALASKA BLACK COD TAKEN NEAR SAN PEDRO.

A specimen of the Alaska black cod (*Anoplopoma fimbria*), 5½ inches long, was taken April 20, 1919, near San Pedro by a sardine fisherman. It has been previously recorded from off Point Loma, near San Diego, by Starks and Morris. It was not recognized by any fisherman in San Pedro, and is apparently a very rare species. Mr. Neilsen of the San Pedro office obtained the specimen for us.—W. F. T.

CANNERY RECEIVES MEXICAN FISH.

There have been several species of Mexican fish brought recently to San Pedro by the Van Camp Sea Food Company. They were obtained near Cape San Lucas by fishermen working for the floating cannery (lately destroyed by fire) belonging to that company, and are noteworthy as perhaps the first fish brought in a fresh condition from so far south. They included the following species:

1. *Caraux hippos*, the "toro," a very dark-meated fish allied to the pompanos and yellowtails.

2. *Neomaenis* sp., the "red snapper," a species closely allied to the snapper of the Gulf States, and hence probably of considerable commercial value.

3. *Xesurus punctatus*, the "cochinito," not generally regarded as of use commercially.

4. *Nematistius pectoralis*, the "pez de gallo," or "rooster-fish," a large fish with long dorsal spines, perhaps nearest to the yellowtail (*Seriola*) but dark meated.

5. *Trachinotus rhodopus*, the "pampanito," a pompano of good eating qualities.—W. F. T.

THE BREEDING SEASON OF THE SARDINE.

In view of the general interest in the habits of the sardine, the following general summary of work on its breeding season is presented:

During the years 1917 and 1918, careful examinations of the sardine were made at intervals to observe the state of the roe. As the summer approached, the examinations were made at more frequent intervals. The net result was to prove that throughout January, February, March, and April the ova increased steadily in average size, but that during May the fish which could be termed mature disappeared in large part.

Later, toward the end of May, there appeared what seemed mature fish with spent and regenerating roe sacks. These were, however, in small numbers and had to be carefully culled from the great numbers of small fish brought in. The fair presumption was that the mature sardines had become inaccessible to the fishermen, either through a seaward migration or a change in habit. No spawning sardines were taken at any time.

The discovery of what appeared to be spent fish in small numbers did not, however, prove that the spawning season had passed, or even that it was well under way. That a certain proportion of most species spawn early, and that there is a period when the spawning is at its height, with a following decline, seems probable. If the sardine is such a species, the finding of spent fish merely means the initiation of the spawning period. That this is probably true would appear from the fact that the roe in no case examined was so close to a spawning condition as to justify a belief that it was distant less than a month.

These facts have been entirely corroborated during the spring season of 1919. A series of samples have been collected and examined daily since the early part of May until the date of writing (May 26), and the same succession of changes have been observed.

The young of the sardine under 30 millimeters in length have been taken in the fine meshed nets of the Albacore during the winter months. Pending a careful examination of these younger forms, it is not attempted to decide the time of the spawning season. The only justified conclusion is that spawning fish are not taken in any numbers by the fishermen.—W. F. T.

CONSERVATION IN OTHER STATES.

REFORMS IN NOVA SCOTIA FISHERY SERVICE.

Four years ago there was hardly a river in Cape Breton Nova Scotia, where trout and salmon were not illegally taken with spear or net every year, and in many streams the fishing had been almost completely destroyed. All of the guardians were political appointees; all were poorly paid, and at least three-fourths were neglectful or inefficient. In July, 1914, the Victoria Fisheries Protective Association was organized, and in the fall of that year its officers made an exhaustive report of 12,000 words to the Minister of Marine and Fisheries of the state of the rivers in Cape Breton Island, and the urgent need of reorganization and reform in the fishery service. In this report, which was accompanied by abundant proof in the shape of six or eight voluminous exhibits, the association pointed out the evils of political control; asked for twelve special guardians with increased salaries; suggested that the number of fishery officers in Cape Breton be reduced from 233 to 50 by the dropping of political workers from the rolls, and recommended that in future all guardians be liberally paid and be appointed for merit only, regardless of political influences.

Nearly all of the recommendations have been adopted. The number of fishery guardians has been reduced from 219 to

44; salaries have been more than doubled; the fishery service has been taken out of politics, and the appointment of all guardians has been entrusted to the Civil Service Commission in Ottawa. Guardians hereafter will be selected for merit only; they will do no political work, and they will devote all of their time to an effective patrol of the streams. Thus, for the first time in more than a generation, the fishery service of Cape Breton Island has been put on a business basis. We now have sixteen head guardians with a salary of $70 a month each, and twenty-eight subordinate guardians with a monthly salary of $25 each. The cost of the guardian service is about the same as it was under the old system, namely $10,400 a year; but the government is now paying that sum to forty-eight guardians instead of distributing it among 219.

STURGEON TO BE PROTECTED IN OTHER STATES.

Several years ago it was found necessary to give the sturgeon total protection in California. Other states now realize that this splendid food fish is almost exterminated and are planning to enact protective legislation. So depleted is the supply in Lake Erie and neighboring waters that Ohio, Pennsylvania, New York, and Canada all propose to protect lake sturgeon for a three-year period beginning in 1919. Although once so common that they formed cheap food for the common people, lake sturgeon are now so scarce that only the wealthy can utilize them. Recently sturgeon have been selling up to 45 cents per pound in the New York market.

LIFE HISTORY NOTES.

NESTING OF THE BAND-TAILED PIGEON.

From an old data book of mine I am able to give the following details of the nesting of the band-tailed pigeon (*Columba fasciata*). The record shows that I discovered a nest at the head of the Lopez Canyon, about ten miles east of San Luis Obispo, in San Luis Obispo County, California, on March 30, 1895. The nest, a flimsy affair made of coarse sticks resembling that of a domestic pigeon, but larger in size, contained but one egg in an advanced state of incubation. It was placed on a live oak limb, near the end of the limb but not among thick twigs. As to identification there was no doubt as I was close enough to the bird to observe the cervical white half collar.

From personal recollection I can supply other details. The nest was built in a small oak tree on a steep hillside not over eight or ten feet from the ground and easily reached by stepping up into the tree. I had been in the habit of hunting pigeons in the fall and winter in the vicinity of Atascadero and Santa Margarita and though I used to visit Lopez Canyon every spring for a number of years never observed the birds to remain there in the spring except this one season. On this particular day I saw perhaps half a dozen pairs of the birds around different parts of the canyon which, in those days at least, was probably not visited more than once or twice a year by anybody. I saw one other nest located within a hundred yards or so of the one above described, but placed so far out on slender limbs above the head of the canyon that it was totally inaccessible.—Nathan Moran.

WILDCAT EATS BIRDS.

On March 10, 1919, I killed a female California wildcat (*Lynx eremicus californicus*) near Coulterville, California, which had been feeding entirely on song birds. The stomach contained the remains of six western robins.—Donald D. McLean.

A DEATH STRUGGLE BETWEEN BUCKS.

While hunting mountain lions on April 26, 1919, east of Squaw Creek in Shasta County, California, I came upon

some locked antlers (shown in the accompanying photograph, Fig. 54. The evidence was clear. There had been a fight between two bucks (owners of these antlers), occurring, probably, some time last November. In the heat of the battle their horns had become interlocked so tightly that they fell without disentangling them. The arena for this buck struggle covered an area of about twenty-five square feet in the corner of a meadow bordering on a small mountain lake. The bucks in their fury had trampled down the grass and vegetation and had even in places plowed up the ground with their hoofs. After a desperate struggle either the animals were overcome by exhaustion or famished from hunger and thirst. Winter came on, and coyotes and other predatory animals prowling around in search of something to devour made a delicious meal on their carcasses, leaving, however, the locked antlers in the condition in which I later found them.—Jay C. Bruce.

Fig. 54. Locked antlers of deer found on Squaw Creek, Shasta County, by Jay C. Bruce. The death of more than one large buck is due to the locking of the antlers when fighting.

REPORTS.

Canned, Cured and Manufactured Fishery Products of California for the Year 1918, Compiled by Department of Commercial Fisheries.

CANNED.

	San Diego, cases	San Pedro, cases	Northern California, cases	Total cases
Abalone—				
1-pound		300	1,425	1,725
Albacore—				
1-pound		17,392		17,392
½-pound		56,214		56,214
¼-pound		9,195		9,195
Anchovy—				
5-pound			1,522	1,522
4-pound			227	227
¼-pound			450	450
Barracuda—				
½-pound	24			24
Bonito and skipjack—				
1-pound	765	2,012		2,777
½-pound	9,527	48,342		57,869
¼-pound	12,310	5,395		17,705
Herring—				
1-pound (oval)			58,330	58,330
½-pound			5,817	5,817
Mackerel—				
1-pound		3,450		3,450
½-pound		4,068		4,068
Sablefish—				
1-pound			25	25
Salmon—				
1-pound (tall)			8,395	8,395
1-pound (flat)			3,304	3,304
1-pound (oval)			197	197
½-pound (flat)			22,540	22,540
Sardines—				
1-pound (oval)	17,790	136,632	593,315	747,737
½-pound (oval)	174	3,788	13,244	17,206
1-pound (round)		138 879		138,879
½-pound (round)	1,101	228,139	945	229,240
¼-pound (round)		51,841		51,841
1-pound (square)		50,076		50,076
½-pound (square), tomato	19,568	70,850	3,716	94,134
½-pound (square), oil			4,249	4,249
¾-pound (square)			133	133
¼-pound (square)	67,785	78,756	3,997	150,538
Shad—				
1-pound			5,056	5,056
Shad roe—				
½-pound			2,213	2,213
Skipjack—				
½-pound	42			42
Tuna*—				
1-pound	5,788	33,825		29,613
½-pound	41,652	164,744		206,396
¼-pound	2,647	29,404		32,051
4½-pound		268		268
Turtle—				
1-pound	300	199		499
½-pound	100	29		129
Yellowtail—				
1-pound	8,328	2,824		11,152
½-pound	31,737	28,537		60,274
¼-pound	405			405

*Includes some albacore.

Canned, Cured and Manufactured Fishery Products of California for the Year 1918, Compiled by Department of Commercial Fisheries—Continued.

SALTED FISH.

	San Diego	San Pedro	Northern California	Totals
Anchovy—				
Barrels	----------	20	310	330
25-pound cans	----------	----------	2,600	2,600
5-pound cans	----------	----------	1,000	1,000
Barracuda—				
Barrels	450	5	----------	455
Black sea bass—				
Barrels	53	----------	----------	53
Bonito—				
Barrels	12	17	----------	29
Mackerel—				
Barrels	110	280	1,521	2,911
18-pound kit	----------	----------	6	6
Rock bass—				
Barrels	9	42	----------	51
Rock cod—				
Barrels	9	2	----------	11
Sablefish—				
Barrels	----------	----------	72	72
Salachini—				
100-pound tubs	----------	----------	5,955	5,955
65-pound tubs	----------	----------	10,899	10,899
50-pound tubs	----------	----------	12,329	12,329
Salmon—				
Casks (mild cured)	----------	----------	2,796	2,796
Sardines—				
Barrels	2	852	107	961
40-pound barrels	----------	----------	1,252	1,252
25-pound cans	----------	----------	1,200	1,200
18-pound kits	----------	----------	6	6
Sea bass—				
Barrels	29	----------	----------	29
Shad—				
Casks (mild cured)	----------	----------	287	287
Yellowfin—				
Barrels	----------	35	----------	35
Yellowtail—				
Barrels	425	76	----------	501

NOTE.—Casks contain 800 pounds net; barrels, 200 pounds net.

Canned, Cured and Manufactured Fishery Products of California for the Year 1918, Compiled by Department of Commercial Fisheries—Continued.

MISCELLANEOUS PACK AND GENERAL INFORMATION.

	San Diego	San Pedro	Northern California	Totals
Albacore—				
Smoked, pounds	----------	31,420	----------	31,420
Kingfish—				
Dried, pounds	----------	19,000	----------	19,000
Sardines—				
Dried, pounds	----------	37,000	----------	37,000
Scotch cured, pounds	----------	4,620	----------	4,620
Yellowtail—				
Smoked, pounds	----------	1,000	----------	1,000
Fertilizer, tons	----------	1,521	----------	1,521
Fish meal, tons	1,123	3,216	2,874	7,213
Fish oil, gallons	17,400	67,858	261,466	346,724
Number of plants	13	34	40	87
Number of employees	1,427	2,783	3,829	8,039
Value of plants	$1,316,000	$2,773,660	$1,569,330	$5,658,990

California Fishery Products for Year of 1918,

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Sutter, Tehama, Glenn, Colusa	Alameda, Contra Costa
Albacore							
Anchovy	100		11,300				
Barracuda							
Bonito							
Bocaccio		1,603	2,061				
Bluefish							
Chilipepper							
Carp		14,834	8,250	23,296	60,294	3,303	86,865
Catfish		90,210		14,571	52,745	4,488	42,159
Croakers							
Coalfish			19				
Cultus cod	1,848	32,413	8,424				
Dolphin							
Dogfish			78,070				8
Flounder	14,793		732	1,522			3,077
Hardhead					10,848	7,309	9,704
Halibut	30,346	61,696	1,140				
Hake			8				
Herring	7,311		3,190,686				1,500
Kingfish			10				
Mackerel							
Marlin							
Mullet							
Pike			1,285	494	1,894	730	8,790
Pompano			3				
Perch	32,039	258	66,183				105
Rock bass							
Rockfish	57,408	6,500	716				
Sole	171		78				
Salmon	1,234,653	1,697,771	172,669	2,305,800	565,834	41,791	2,957,492
Smelt	13,209		24,012				316
Shad (roe)				194,549	35,168		673,237
Sea bass (white)			10,921				
Shad (buck)				159,921	13,990		241,015
Sea bass (black)							
Sanddab							
Suckers					6,719	190	358
Striped bass			22,773	353,100	113,578	5,066	751,830
Shad			1,639	224,773	104,813	2,069	671,804
Surf fish							
Stingaree			151,500				
Sturgeon							
Sardine	908	240	451				
Skipjack							
Skate							
Sheepshead							
Seulpin							
Splittail					3,139	3,726	1,115
Sea trout							
Swordfish							
Tom cod							
Trout (farm)							
Trout (steelhead)	21,819						
Tuna							
Turbot			3,087				
Whitebait		100	9,297				
Yellowtail							
Miscellaneous	2,000				3,640	3,251	41
Total fish	1,416,605	1,3 5,025	3,765,305	3,278,026	972,702	71,923	5,449,497
Crustaceans—							
Crab (dozen)	4,128						13
Spiny lobster							
Shrimp							
Ecrevisse							
Mollusks—							
Squid			85				
Cuttlefish		100	10				
Clam (Pismo)							
Clam (cockle)			23,652				
Clam (softshell)	1,085	13,105	125,575				173,278
Clam (mixed)	20,211	1,867	72,842				10,780
Oyster, eastern (shell), number			885,811				
Oyster, native, pounds			39,279				
Abalones	1,935	405					
Sea snails							
Mussels	760		673				4,297
Reptiles—							
Terrapin (dozen)			25				
Sea turtles							

Compiled by Department of Commercial Fisheries.

San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego	Imperial	Totals	Mexico
----------	39	5,084	918	6,434,770	230	822,854	----------	7,263,895	1,527
257,170	----------	540,323	----------	49,392	----------	9,566	----------	867,851	310
17,160	66,899	37,572	41,185	1,988,598	9,343	1,724,934	----------	3,885,691	951,593
----------	33,541	6,607	13,046	978,120	363	1,233,087	----------	2,264,164	176,667
49,351	106,081	1,083,074	----------	----------	----------	----------	----------	1,242,170	----------
----------	558	69,340	----------	185	----------	----------	----------	70,083	----------
209,172	89,537	54,622	----------	----------	----------	----------	----------	353,331	----------
36,073	----------	----------	----------	79,859	----------	----------	----------	312,774	----------
712	----------	----------	----------	----------	----------	----------	----------	204,876	----------
----------	----------	----------	----------	56,031	----------	11,095	----------	67,126	----------
478,844	3,593	11,530	----------	4,221	730	----------	----------	498,937	----------
446,796	123,853	300,432	----------	1,613	457	----------	----------	915,836	----------
----------	----------	----------	----------	741	----------	----------	----------	741	----------
274 099	500	11,359	----------	14,731	----------	21,711	----------	400,478	2,615
716,080	47,178	27,243	----------	6,679	240	1,291	----------	818,835	----------
----------	----------	----------	----------	----------	----------	----------	----------	27,861	----------
40,990	8,619	25,544	309,378	1,145,734	13,974	1,201,166	----------	2,837,987	1,915,704
143,678	47,313	2,019	64	17,094	----------	8,496	----------	218,672	5,369
4,732,883	5,900	----------	----------	----------	----------	----------	----------	7,938,280	----------
62,726	83,342	154,128	734	650,281	349	23,525	----------	975,095	----------
----------	973	1,489,163	4,497	2,346,048	6,242	158,983	----------	4,005,906	70,178
----------	----------	----------	----------	2,275	----------	----------	----------	2,275	----------
----------	----------	----------	----------	30,267	----------	----------	59,390	89,657	1,745
172	----------	----------	----------	----------	----------	----------	----------	13,365	----------
1,786	2,752	6,699	44	12,876	----------	100	----------	24,260	----------
52,810	10,180	6,551	1,616	26,771	374	1,280	----------	198,167	365
----------	----------	----------	6,393	535,375	3,644	231,233	----------	776,645	7,219
1,340,106	644,450	1,109,737	123,395	1,575,558	25,512	1,398,043	----------	6,281,425	12,912
4,696,906	1,893,705	293,529	85,749	53,110	106	4,353	----------	7,027,767	----------
1,756,134	209,923	2,682,953	----------	1,065	----------	----------	----------	13,026,076	----------
2 3,900	32,550	164,388	30,747	196,809	76,910	46,082	----------	788,923	8,061
----------	----------	----------	----------	----------	----------	----------	----------	902,894	----------
40,413	171,885	59,137	64,648	1,015,478	1,054	88,942	----------	1,452,478	154,853
----------	----------	----------	----------	----------	----------	----------	----------	414,926	----------
----------	----------	248	6,184	97,432	2,969	103,599	----------	210,432	38,363
1,380,057	308,403	41,154	----------	21,970	25	----------	----------	1,751,609	----------
----------	----------	----------	----------	----------	----------	----------	----------	7,267	----------
161,353	47	94	----------	----------	----------	----------	----------	1,407,841	----------
60,717	----------	----------	----------	----------	----------	----------	----------	1,065,815	----------
----------	----------	----------	----------	4,888	----------	----------	----------	4,888	----------
----------	----------	----------	----------	300	----------	----------	----------	151,800	----------
----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
892,026	559,265	64,915,002	42	78,077,612	----------	13,207,265	----------	157,652,811	----------
----------	728	155	----------	3,019,686	135	3,145	----------	3,023,847	----------
232,801	2,090	4,078	425	6,809	28	----------	----------	246,231	----------
----------	----------	----------	45	8,605	----------	13,838	----------	22,488	490
165	----------	2	----------	28,156	----------	81	----------	28,404	----------
----------	----------	----------	----------	----------	----------	----------	----------	7,980	----------
----------	----------	----------	----------	4,902	941	346	----------	6,189	----------
----------	----------	----------	----------	17,862	----------	580	----------	18,442	----------
8,756	55	----------	----------	39,566	159	----------	----------	48,536	----------
1,657	1,781	----------	----------	----------	----------	392	----------	3,830	----------
----------	----------	----------	----------	----------	----------	----------	----------	21,819	----------
----------	315	1,580	1,174	5,897,961	----------	429,941	----------	6,240,971	----------
----------	----------	----------	525	52	----------	----------	----------	3,664	----------
108,053	----------	81	18,326	----------	----------	----------	----------	135,857	----------
21,520	124,052	137,261	20,782	5,926,021	1,060	5,427,563	----------	11,658,259	139,946
93,366	1,001	36,863	14,928	139,409	3,175	31,940	----------	329,614	264,163
18,518,432	4,581,108	73,276,952	744,845	110,424,912	148,078	26,205,431	59,390	250,218,041	3,752,071
62,079	707	531	----------	----------	----------	----------	----------	67,458	----------
----------	----------	----------	29,979	120,796	2,611	42,364	----------	195,750	735,077
722,178	----------	----------	----------	----------	----------	----------	----------	722,178	----------
----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
1,970	850	301,007	----------	43,376	----------	14,426	----------	361,714	----------
14,583	4,406	13,268	----------	372	----------	----------	----------	32,739	----------
----------	517	----------	665,167	----------	----------	----------	----------	665,684	----------
----------	----------	----------	160	21,121	----------	----------	----------	44,933	----------
----------	----------	----------	----------	----------	----------	----------	----------	313,043	----------
344	252	340	1,359	21,089	----------	----------	----------	129,084	----------
5,302,210	----------	----------	----------	----------	----------	----------	----------	6,188,021	----------
----------	----------	----------	----------	----------	----------	----------	----------	39,279	----------
----------	----------	365,986	183,863	50,730	----------	----------	----------	602,919	----------
----------	----------	----------	----------	1,461	----------	----------	----------	1,461	----------
5,334	4,270	600	9,954	21,251	600	580	----------	48,319	835
----------	----------	----------	----------	----------	----------	----------	----------	25	----------
----------	----------	----------	----------	----------	----------	18,135	----------	18,135	12,496

CALIFORNIA FISHERY PRODUCTS.

Compiled by Department of Commercial Fisheries, January, February, March, 1919.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Glenn, Colusa, Sutter, Butte	Contra Costa, Alameda	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego	Imperial	Total	Mexico
Albacore												348		30		378	13,647
Anchovy										9,120		114,500		100		123,720	
Barracuda								13			35,575	37,653		101,498		174,739	424,451
Bonito											50	75,653		3,853		79,556	91,542
Bocaccio								8,056	38,213	498,030						544,299	
Bluefish								9,540		15,172						24,712	
Chilipepper										13,444						13,444	
Carp		3,660		2,332	62,428	80	40,956	335				50				109,841	
Catfish		23,313		3,569	20,488		5,174									52,544	
Coalfish								75			18	132				225	
Cultus cod	300							117,193	18,177	50,246		26				185,942	
Dogfish				11				74,940	235	100	2,530	18,994		55,162		151,972	
Flounder	10,095		454				2,233	64,897	21,203			6,092				104,974	
Halibut	43							16,604	2,652	927	64,751	597,768	12,048	105,622		800,415	175,004
Hardhead					24,744		1,416									26,160	
Hake								483	1,156			9,452		770		11,861	755
Herring	6,419		3,714,638				59,822	470,891	350							4,252,170	
Kingfish			32					21,743	10,087	5,553	961	254,802	43	6,920		300,141	55
Mackerel									29	216,018	164	38,795	33	6,556		261,595	2,640
Mullet															2,359	2,359	
Pike				433	1,410	10	2,532									4,385	
Pompano			2					4	200	206		44,836	32	66		45,346	
Perch	15,824		16,767				46	5,918	9,608	2,668		2,542		12		53,325	
Rock bass												16,053	85	25,478		41,616	6,905
Rockfish	1,166							576,596	150,768	151,935	30,365	630,140	2,716	312,295		1,855,861	39,470
Sole								1,056,534	116,820	13,825	43,626	46,034		4,134		1,280,973	
Salmon	263			40,099	15,208	71,695	137,553	1,646	1,687	216,430						484,491	
Smelt	6,913		11,045				245	71,798	2,612	1,307	1,087	43,266	23,882	23,720		185,875	1,375
Sea bass (white)			719					265	165	135	681	57,357	56	5,933		65,311	3,425
Sea bass (black)												10,389	791	9,631		20,811	815
Sanddab								139,207	11,177	158		2,585		651		153,778	
Suckers					3,276											3,276	
Striped bass			810	62,347	10,702		153,898	20,923								248,680	
Shad, roe				837	81		12,301									13,219	

Shad				11,928	4,221		15,048	821								32,018	
Shad, buck				615			18,901									19,516	
Splittail					12,567		10,490									23,057	
Sardine								11,745	385,840	16,778,984		29,205,399		4,780,739		51,162,707	
Skate								112,659	908		150	7,319	475			121,511	
Stingaree								4,000						824		4,824	
Sculpin												3,915		104		4,019	
Skipjack												210				210	
Sea trout												1,655	15	862		2,532	42
Sheepshead												5,298		8,342		13,640	
Tom cod								8,018								8,018	
Trout (lake)																	
Trout (steelhead)																	
Turbot				90												90	
Tuna												789		123		912	
Whitebait				367				1,647								2,014	
Yellowtail												178,889	189	39,376		218,454	11,253
Miscellaneous	356							21,413	505	1,370	12,476	124,035	1,472	1,339		162,966	10,804
Total fish	41,319	26,973	3,744,974	122,081	155,125	71,785	460,615	2,817,964	772,392	17,975,568	192,374	31,534,976	41,837	5,494,140	2,359	63,454,482	792,183
Crustaceans—																	
Crab (dozen)	721							8,196	285	79						9,281	
Spiny lobster											5,093	43,786	3,912	7,466		60,257	193,580
Shrimp								137,886								137,886	
Ecrevisse																	
Mollusks—																	
Squid												1,119		445		1,564	
Cuttlefish			36					2,292	608	4,878		72				7,886	
Clam (Pismo)									75		110,126					110,201	
Clam (cockle)			3,874								560	2,649				7,083	
Clam (softshell)		3,307	13,204				62,472									78,983	
Clam (mixed)	9,760	626	10,086								2,228	218				22,918	
*Oyster (shell), No.			359,286					1,900,700								2,259,986	
Oyster (native), No.			14,856													14,856	
Abalones									225	26,220	39,891					66,336	
Mussels	380						1,535		940	925	6,313	1,266		100		11,459	
Sea snails												653				653	
Reptiles—																	
Terrapin (dozen)		62														62	

*Eastern.

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CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

Volume 5 SACRAMENTO, OCTOBER, 1919 Number 4

CONTENTS.

	Page
SOME NOTES ON DRY-FLY FISHING—*R. L. M., California*	169
NOTE ON THE HABITS AND USE OF THE SMALL SAND CRAB (*EMERITA ANALOGA*)—*Frank W. Weymouth*	171
GAME CONDITIONS IN SOUTHERN CALIFORNIA THIRTY-FIVE YEARS AGO—*M. Hall McAllister*	172
A CASE OF DESTRUCTION OF PISMO CLAMS BY OIL—*Frank W. Weymouth*	174
ACCUSATIONS AND THE DEFENSE—	
The Eden Resolution and a Reply	176
EDITORIALS	187
FACTS OF CURRENT INTEREST	195
COMMERCIAL FISHERY NOTES	196
NOTES FROM THE STATE FISHERIES LABORATORY	200
CONSERVATION IN OTHER STATES	204
LIFE HISTORY NOTES	205
UNITED STATES FOREST SERVICE CO-OPERATION	206
REPORTS—	
Seizures	207
Fishery Products, April, May, June, 1919	208
Violations of Fish and Game Laws	210
Expenditures	211
INDEX	213

SOME NOTES ON DRY-FLY FISHING.

By R. L. M., California.

There is really no mystery in connection with dry-fly fishing; everybody who has fished with the wet fly must have noticed that the first time that a new or dry-fly is cast on the water, that it remains on the surface; in other words, it floats. As soon as the fly becomes wet it ceases to float and thus becomes a wet fly. Now, dry-fly fishing merely consists in keeping the fly dry, and if it should become wet, of drying it with as little loss of time as possible.

Owing to more or less recent discoveries, several aids have been found which greatly assist the fisherman in keeping his fly from becoming waterlogged. The most important of these is the "oil tip." The honor of this discovery belongs to the late Thomas Andrews, of Surrey, England, who obtained it from Colonel Hawker, a descendant of Colonel Peter Hawker (Diary 1802-53; "Hints to Young Sportsmen"). "Odorless paraffine" is the fluid generally mentioned. This is not always easy to obtain. However, there is another oil that from my own personal experience is equally efficacious. I refer to the well known and useful "3 in 1." The best method of applying "3 in 1" to a fly is to dip the fly in the oil, then lay it on a piece of

blotting paper to drain while breakfast is being eaten. A fly treated in this manner will continue to float bone dry until it is worn out or the day's fishing is over.

Another very useful thing to have at the waterside is a piece of amadou. This substance, which looks like leather, is a fungus that has the property of rapidly absorbing moisture. If the fly is *very wet* it can be pressed between a folded piece of amadou and nearly all the moisture is removed.

But all said and done, most of the drying out of a fly is done by switching or casting the fly back and forth in the air. Anybody who is able to throw a fly can in a very short time learn how to do this without snapping off his fly.

The first thing to remember is that the fly should not be thrown *at* the water. Learn how to cast the fly so that all the impetus imparted to the line is used up by the time the fly is still *above* the surface of the water, and allow the fly to fall of its own weight on the water.

Now, when this feat can be accomplished with ease, instead of letting the fly fall on the water, make a backward stroke similar to that which is made when picking the line and fly off the water; this will extend the line behind. A series of three or four of these backward and forward strokes (which are called false casts) are made between each true cast, and this action called "drying the fly" is the principal thing that differentiates between wet and dry-fly fishing. Of course, there are other things to be taken into account, about which I hope to say more at some later date, but the whole secret consists of being able to throw the fly backwards and forwards in the air without permitting it to touch the water in front or the ground behind. When that can be done the major part of the art is conquered.

In actual practice the false casts will be made at an elevation corresponding roughly to the top of the rod, whether the overhead or horizontal cast is being used.

I strongly advise the beginner to commence his dry-fly fishing with hackle flies, for the following reason: A hackle fly, having no wings, is always "cocked up"; whereas, a winged fly should float with its wings standing up in the air, and placing such a fly on the water properly "cocked up" does not come to one overnight. But as soon as the beginner becomes proficient in putting a hackle fly lightly on the water he can switch to the winged variety and note results. If the fly persists in floating on its side, *i.e.*, with one or other wing in the water, it shows that there was too much force used in making the cast; because the fly, instead of falling of its own weight onto the surface, was propelled thereon, with sufficient force to topple it over on its side. As time goes on, however, the fly will more often fall correctly and float lightly on the surface with an extraordinary resemblance to the natural insect.

Do not become discouraged if you do not become an expert dry-fly fisherman in a few days. Have patience and be persevering and in a surprisingly short time, all things considered, you will find yourself accomplishing things you once considered almost impossible. The great test of the art is to be able to tell when a fly is dry or otherwise, by the feel of the line when making the false or drying casts. When you can do this your novitiate is in the past.

NOTE ON THE HABITS AND USE OF THE SMALL SAND CRAB (Emerita analoga).*

By FRANK W. WEYMOUTH, Stanford University.

Of the many baits used for surf and pier fishing in southern California, few are more popular than the "soft-shelled" sand crab, of which numbers may be seen for sale in the fish markets on the piers at Santa Monica, Venice, Long Beach, Coronado and other coast towns. Some recent observations on its habits suggested that those who use it as bait might be interested in its mode of life and where it may be caught.

The small sand crab, as it may be called to distinguish it from a larger form also found in the sand, or more technically *Emerita analoga*, is found on sandy beaches exposed to the open ocean along the entire coast of California, but never in bays or other sheltered locations. The reason for this will be clear when we have considered its feeding habits. At the level washed by the waves it burrows in the sand, and is found grouped in beds which can be recognized even at a distance by peculiar diamond-shaped ripple marks in the water running off the sand after the breaking of the wave. These ripples are caused by the feathered "feelers," or antennæ, of the sand crab, which it thrusts up into the receding wave. With these it combs from the water the microscopic animals and plants upon which it feeds.

If one has patience to wade into such a bed and wait quietly until the crabs have recovered from their first alarm, the interesting process of feeding may easily be watched. As the water clears of sand after the inrush of the wave, dozens of pairs of the plume-like antennæ will be seen to pop out of the sand into the seaward-running water, where they remain until the wave drains off, occasionally disappearing for a fraction of a second to be freed of their catch of tiny organisms. Corresponding to this habit of feeding on material too fine to be chewed, the jaws, which have hard-cutting edges in other crabs, are here small, soft, degenerate vestiges.

If a shovel is thrust into the sand of one of these "beds" it will turn out scores of these crabs which "dig in" again so rapidly that few can be caught. If numbers are wanted the best way to catch them is to shovel the sand, crabs and all, into a box having wire screen in the sides, and let the sand be washed out by the waves as they sweep in and out. Another but less efficient method sometimes practiced is to hold a screen across one of the sand gullies found in this part of the beach and so catch the crabs which happen to be swimming about in the receding wave.

Observations recently made show that the crabs move up and down the beach with the tides so that the beds may always be found in the area washed by the waves, and here they may easily be recognized by the ripple marks already mentioned.

Crabs caught by any of these methods will be noticed to differ much in size. In this species, unlike most of the crustacea, the males are much smaller than the females, and it will be found during the breeding season, which falls in the summer months, that only the

*California State Fisheries Laboratory, Contribution No. 8.

larger specimens are carrying egg masses. The "soft-shelled" crabs are, of course, not a separate form, but only those that have recently molted or cast their shells, a process occurring yearly in most crustaceans, and that have not yet hardened their new shells. According to observations just made, the molting of the large females apparently occurs just before spawning and in advance of the molting of the males, and it is these "soft" females which are collected as bait for surf fishing. Fish are apparently used to feeding on these crabs, which in their soft state have more difficulty in burrowing into the sand than at ordinary times and are therefore more likely to be found swimming about at the bottom. The fisherman, in using the "soft-shelled" sand crab, is therefore offering to the fish one of its customary dainties, and it is readily accepted.

GAME CONDITIONS IN SOUTHERN CALIFORNIA THIRTY-FIVE YEARS AGO.

By M. HALL McALLISTER.

In 1885, I spent the summer and fall in and near Colton, Riverside and San Bernardino, in southern California, and most of the months of September, October and November in riding and hunting all over that part of California. My companion was a rancher, V. C. Reche, who was one of the best shots, deer trackers and general all-round hunters to be found anywhere.

We had one week's hunt on the Santa Margarita, also known as the Juan Foster-Dick O'Neill-Flood property, near Oceanside. Our party of four bagged fourteen deer and could have killed double the number, but stopped shooting because they were nearly as tame as sheep.

There were then some antelope just south of Riverside, and I have now the horns of a buck killed not far from San Jacinto Mountain, near where the town of Hemet now stands. Mountain sheep could then be found in either the San Bernardino or San Jacinto ranges, and my hunting friend Reche had killed several. I also remember a miner who reported a very large grizzly as coming daily to the mountain side near a mine to feed on the berries. This mine was on the desert side of the Cajon Pass where the Santa Fe Railway comes down from Barstow. Mountain lions were also plentiful all through these ranges. I remember a friend reporting that while riding through a canyon not far from his ranch he suddenly came on a bunch of five lions feeding on a dead calf, and as he had no weapon with him he thought best to make a quiet sneak.

On the San Jacinto plains south of Riverside were a few springs, and to these the quail came in countless thousands to water, and at nearly each one of them we found a brush hut and a V-shaped trough placed there by the quail market hunters. Reche and I went around and burned up each and every one of these "slaughter pens" and got ourselves somewhat disliked when the news leaked out as to who had done it.

When the quail season opened in September we had many splendid hunts, but no potting was allowed, wing shooting only; and with birds so plentiful, we had wonderful sport. I remember one hunt where we slept out at one of these San Jacinto plains springs and in the morning saw the enormous bands of quail coming up for water. It made one's blood tingle with excitement. The ground for hundreds of yards all around was a moving mass of thousands of running birds. We hid in the brush and let them come in to water, then suddenly jumped up with a shout and succeeded in scattering the flock so that in an hour's shooting we had bagged 97 quail, all wing shots. We did not move more than one hundred yards from the spring, as every rock on the hillside had from one to a dozen quail under it.

Mr. Reche stated that when the Sunset Route of the Southern Pacific started in 1880, many young men in southern California started hunting quail for the San Francisco market, but that nearly all the quail rotted in the sacks before reaching San Francisco, so that the business proved unprofitable. Before refrigeration could be arranged, the big bands of quail were all killed off. He stated that with his brother he started to shoot for the market, but his returns did not pay the express charges and the cost of powder and shot. He stated that by actual count he picked up 363 quail as a result of eleven pot shots of his old muzzle loader at the spring where we found the V-shaped trough. This was an average of 33 birds to each shot, and he said he would wait until the trough was actually covered with quail before he would shoot.

Coming back to recollections in and around my home in San Francisco, I remember that in the summer of 1875 I visited a camp of young men in the mountains back of Pescadero, in San Mateo County. This was in July and there was a game law against shooting quail, but these men, "just for the fun of it," were potting quail by the hundreds and had a large sack full; in fact, so many that their camp could not eat them and we were invited to "help yourself if you will keep your mouth shut."

In the California Market, San Francisco, in the seasonal months from September to February, the oyster cafes served "quail on toast, 25c," and when I lunched there my daily order was this most palatable dish.

Remembering the adage, "You can not eat 30 quail in 30 days," I tried and accomplished the feat. It was supposed the adage came from the idea that a person could not obtain quail on each day of thirty consecutive days or that you would so tire of them that you could not carry out your bargain. However, as stated above, I did obtain and did eat a quail each day for thirty consecutive days. I might state that the restaurant had a fine cook who understood how to prepare them with plenty of butter, and they were delicious.

As I was working and had to keep regular office hours in San Francisco, most of my hunting was on Saturdays and Sundays and occasional holidays and vacations. I have a journal and record book of all my hunts from 1877 down to the present year, 1919, just forty-two years. Most of the shooting has been at ducks and geese on the Suisun marsh, where I was a member of the Cordelia and Ibis shooting clubs.

A CASE OF DESTRUCTION OF PISMO CLAMS BY OIL.*

By PROFESSOR FRANK WALTER WEYMOUTH, of Stanford University, California.

That crude oil is harmful to marine and fresh water animals has been so generally recognized that most states, including California, have passed laws designed to protect their waters from oil by providing penalties for those who allow it to escape. Definite instances proving its destructive effect though present, for instance in the case of water birds, are not numerous, and for this and other reasons convictions are not always easy to obtain. It is claimed by the clam diggers at Pismo and Oceano that oil is chiefly responsible for the decrease in the supply of Pismo clams. It is hoped that at another

Fig. 55. Oil cakes on the beach near Pismo. The size may be judged by comparison with the cap. Photograph by W. E. Weymouth.

time it will be possible to present an analysis of this claim and of other factors influencing the abundance of this important food mollusk, the data for which are not now available, but an instance of the effect of oil which recently came under the writer's notice may here be put on record.

Sometimes oil reaches the beach from tanks on the shore near Avila, but the most important source is from the water ballast discharged by vessels coming to load oil at Port San Luis. This can not reach the beach at Morro around the projecting "Pecho" coast against the prevailing winds, but is blown on the beaches at Pismo and Oceano at times in considerable quantities as bathers at these resorts are

*California State Fisheries Laboratory, Contribution No. 11.

well aware. One such instance was observed by the writer on June 1 of the present year, when along more than a mile of the beach just south of Pismo large masses of fresh oil were found scattered over the wet sand exposed at low tide. The appearance at two points is shown by the accompanying photographs, from which the size and abundance of the oil cakes may be judged. In fact, at this time it was impossible for a bather to cross the beach without getting so much oil on his feet as to make a gasoline footbath necessary. Many old cakes well mixed with sand and free of the thinner oils may be seen at any time high up on the beach, showing that the occurrence is by no means rare. On the date mentioned the lighter parts of the oil, churned up by the surf into an emulsion, were found sweeping back and forth across the sand at the tip of the advancing waves, and in this were large numbers of small animals either dead or so feeble as no longer to be able to burrow. About a quart of small clams, chiefly razor shells (*Siliqua*), but including some thirty small Pismo clams (*Tivela*), together with a few sand crabs (*Emerita*) and some worms were picked up in a few minutes. All were smeared with oil; some of the clams were dead and gaping, others were alive, but too feeble to keep up the constant burrowing necessary to maintain their place in the sand from which the waves had washed them. Whether the oil killed them directly or, what is more probable, by filming over the sand cut off the supply of air, could not be determined. But that they were killed by the oil can not be doubted, as examination of the beaches for two or three weeks before and after this date seldom showed even a single dead clam except in the presence of oil.

With this clear proof of the destructive effect of the oil on such an important food animal as the Pismo clam, there can be no excuse for tolerating the escape of oil, especially as it has been proved possible by devices in use on many tankers not only to prevent its escape, but to save the oil thus usually lost.

If you are inclined to criticise the Fish and Game Commission, read the following criticisms and the defense.

If you believe in the work of the Commission, inform yourself more fully as to the accomplishments of the past few years.

ACCUSATIONS AND THE DEFENSE.

Resolution by Mr. Eden, introduced in the State Legislature April 1, 1919, and referred to Committee on Governmental Efficiency and Economy.

WHEREAS, The Fish and Game Commission of this state, and its several members, officers and assistants, are, by virtue of the very large power and authority given to them by law, in a position to exert great influence for or against legislation pending before this Assembly; and

WHEREAS, It is said that certain of said officers and members have in fact sought to influence pending legislation; and

WHEREAS, Said Fish and Game Commission and certain of its members, assistants and employees have been derelict in the performance of the duties imposed upon them by law; now, therefore, be it

Resolved, That the Committee on Efficiency and Economy of this Assembly be and it is hereby, directed to make an immediate and thorough investigation of the following specific matters:

1. To ascertain what, if any, fishing clubs, gun clubs and private game preserves, any of the said commissioners, or the officers, assistants or employees of said Fish and Game Commission, are affiliated with; and whether or not any of said officers, assistants or employees have been, by reason of such affiliation, perniciously active in supporting or opposing any legislation now pending before this Assembly; and whether or not they have shown any favoritism, in any manner, towards any gun or fishing club members; and whether or not they have, by reason of their said membership, sought to set up and perpetuate in this state, against the interests and wishes of the common people, the European system of a monopoly in the control and use of wild fish and game, which is peculiarly the property of all the people.

2. Why it is that within the past nine years said commission has, without any satisfactory explanation, dismissed three certain executive officers of said commission, each of whom was reputed to be a faithful and efficient public servant.

3. How much of the time of the present attorney of said commission is devoted to the duties of his state office, and how much of it is devoted to his own private law practice; the latter of which is said to be very large and lucrative.

4. Why said commission collected from the people of the State, during the four years ending June 30, 1918, the enormous sum of $837,409.25, of which the sum of $708,310.75 was expended; whether or not said sum so spent was not unwisely and extravagantly used. Also recommend some legislation that will reduce the amount of money collected by said commission at least $30,000 per annum. Also to ascertain if it is not advisable that the expenditure of such a large fund should be made by the governing body of the State, upon appropriations, instead of by said commission, as is now done, without any control of the Legislature whatever.

5. Why it is that for the two years ending June 30, 1918, the police work of the commission fell off about 15 per cent over the preceding two years (see last report to Governor, page 88); notwithstanding said commission is charged with the enforcement of laws for the preservation of fish and game, and notwithstanding more people hunted and fished during said period ending June 30, 1918, than before; and notwithstanding reports of frequent and flagrant violations of the fish and game laws were reported in the press and otherwise throughout the state.

6. Why said commission expended the enormous sum of $68,272.21 to establish and a large sum since for additions to a trout hatchery in Inyo County, for the purpose, as avowed by the said commission, of stocking the streams of southern California and the western slope of the southern Sierra Nevadas, when it was obvious to any person that said location could not be a success for the following reasons:

a. That there were no waters nearby needing to be stocked.

b. That it was impossible to obtain a sufficient supply of trout eggs in that vicinity for hatching purposes.

c. The great distance the hatchery product must be transported at heavy expense.

d. The hatchery product must be transported through the heat of the Mojave desert before they reach the waters intended to be stocked.

7. To ascertain the cost of maintenance and operation of said hatchery in Inyo County, and whether the said cost is not extravagantly expensive and out of all proportion to the benefit derived by the people of the state, and likely to be a growing burden and expense; also the person from whom the ground was purchased and the then owners of adjacent property and the price paid therefor.

8. To ascertain whether or not the commission is making any intelligent and sufficient effort to obtain accurate first-hand information relative to the present status and condition of the game and fish of the state; and whether or not by reason of failure to procure such information many species of game and fish have reached the point of actual extinction, with others in the same dangerous stage of diminution, before proper conservation measures can be proposed to this Assembly.

9. Why said commission has permitted the Truckee River, one of the most beautiful streams in the world, and a famous fishing ground, to remain polluted for years by the waste products from a paper mill located at Floriston, California, notwithstanding popular complaint and objection by the citizens, not only of our state, but also by the people of our sister state, Nevada, whose principal city obtains its domestic water supply from said river; and notwithstanding said commission is required by law, and clothed with all lawful authority, to prevent the pollution of streams. Why it is that in the face of the law said commission has deliberately and wilfully failed and refused to do its plain duty, thereby constituting a clear and flagrant malfeasance in office, and one that should be severely dealt with by the proper authorities.

10. Why it is that the ocean waters of San Luis Obispo County and the waters of San Pablo and San Francisco bays, and other navigable fishing waters in the state, have been for years, and are now, being polluted with crude petroleum, oil refinery refuse and other substances deleterious to fish life, in violation of law; notwithstanding it is the duty of the Fish and Game Commission strictly and impartially to enforce the law against such pollution.

11. To ascertain whether or not, throughout the state, in irrigated districts, many canals and irrigating ditches are diverting water from streams that contain fish, without using screens to prevent the loss of fish; and thereby millions of trout, bass and other valuable food and game fishes are annually killed and wasted.

12. To ascertain to what extent dams and other artificial obstructions are being suffered by the said commission to be maintained in the streams of the state without proper fish ladders, and whether or not by such neglect and dereliction of duty on the part of said commission, millions of trout, and other migratory fish, are prevented from reaching proper "spawning beds," with a resultant loss of a great quantity of fish spawn and fish.

13. To ascertain if it is not true that the Fish and Game Commission has failed and neglected to take advantage of that provision in the law authorizing the creation of game refuges on private land holdings, resulting in game, in many sections where hunting is intensive, failing to receive proper and adequate protection.

14. Why said commission has discontinued a branch office established at the request of the people of the San Joaquin Valley; thus making less effective the supervision of police and other conservation activities in that important and developing region; and thereby, and through other activities, having lost to the state the services of one of the most efficient and conscientious fish and game conservationists in the country.

15. To ascertain if it is not true that said commission has wasted large sums of the people's money in unscientific and impractical experiments at its game farm at Hayward, California, and has finally abandoned said farm.

16. To ascertain if it is not true that the distribution of fish, as carried on by said commission, is unscientific, unduly expensive and results in the destruction each year of a large proportion of the fish so distributed.

17. To ascertain if it is not true that because said commission has failed to investigate and prevent enormous losses occurring among the millions of young salmon propagated and distributed each year after they leave the hatcheries, the salmon fisheries of the Sacramento and San Joaquin rivers are not being kept in a healthful and thriving condition.

18. To ascertain to what extent, if any, said commission has, within the past eight years, been governed by political, personal and other insufficient and improper motives, in its acts in the following particulars:

a. The dismissal of trained and efficient employees.

b. The employment, promotion and otherwise rewarding of assistants and employees not deserving of such consideration.

c. The failure to promote certain assistants deserving promotion.

And whether it is not true that by reason of said acts the entire department is demoralized and functioning very inefficiently and at an expense out of all proportion to the results obtained.

19. To ascertain if it is not true that the force of wardens in the field, where the fish and game are to be found and where constructive work can only be done, is inadequate; while the "overhead" has been constantly increased by adding to it expensive and unproductive clerical workers; be it further

Resolved, That said committee report to this Assembly within a short time, the result of its investigation, with such recommendations as it may deem advisable; be it further

Resolved, That said committee be, and it is, hereby authorized and empowered to compel the attendance of witnesses at its several sessions, by subpœnas, to be served by the clerk of said committee; and that the chairman and vice chairman of said committee be and they are each of them authorized to administer oaths to witnesses; and any witness refusing to answer questions is hereby declared to be in contempt, and may be punished as for contempt.

Said committee is empowered to employ all needed clerical and expert assistance to carry on said investigation, and all costs and expenses of such investigation shall be paid out of the Contingent Expense Fund of this Assembly, not exceeding one thousand five hundred dollars.

Reply to the Eden Resolution by the Executive Officer of the Fish and Game Commission.

In the preamble of Mr. Eden's resolution introduced in the Assembly, April 1, 1919, it is stated that some of the members, officers and assistants of the Fish and Game Commission appear before the Legislature. While this is true, they do so merely in an advisory capacity and have not at this or any other session of the Legislature, attempted to influence any legislation for personal motives. They have favored the legislation which they thought was best for the conservation of the fish and game of this state and have opposed legislation which, in their opinion, was harmful or vicious.

A general statement is made that certain members, assistants and employees of the commission have been derelict in the performance of the duties imposed upon them by law, but no specific instances have been enumerated. The statement is untrue. Assistants or employees found derelict in the performance of their duties have been promptly discharged from the service of the commission.

The following is a brief reply to each of the nineteen points set up in the resolution:

1. The fact that two of the three commissioners are members of gun clubs has in no way influenced them in showing any favoritism towards gun clubs nor have they been perniciously active in supporting or opposing legislation pending before the Assembly, nor have they sought to establish the European system of monopoly in the control and use of fish and game, against the interests and wishes of the common people. On the contrary, they have always sought to perpetuate fish and game in this state for the benefit and use of all the people. Commissioner Bosqui is not a member of nor in any way affiliated with any hunting or fishing club nor with any game or fishing preserve.

2. It is not true that within the past nine years the Fish and Game Commission has dismissed three executive officers of the commission. Charles A. Vogelsang severed his connection with the commission long before Commissioners Newbert and Bosqui were appointed and several years prior to the time the present executive officer became connected with the commission.

John P. Babcock, after several conferences with Governor Hiram W. Johnson, resigned on November 24, 1911.

Ernest Schaefle voluntarily resigned on September 15, 1916. Both resignations are now on file in the office of the commission.

3. Mr. Robert D. Duke, attorney for the commission, devotes all of his time to the duties of his state office.

4. During the four years ending June 30, 1918, the Fish and Game Commission collected the sum of $837,409.25, because under the laws of the state, it was its duty to collect said sum. This money was paid into the Fish and Game Preservation Fund by hunters, anglers and commercial fishermen who desired that it be used for the purpose of conserving fish and game and not that it be diverted into the general fund to be used for other purposes. It is their wish that these funds be spent on patrol, enforcement of fish and game laws, erection and maintenance of hatcheries, distribution of fish, installation of screens in ditches, fishways in dams and research, etc.

The fish canners and commercial fishermen, of their own accord, asked that a privilege tax be imposed on the taking of fish and that the money from this source be turned over to the Fish and Game Commission for the purpose of conducting investigations of the life history of fishes in order that the commercial fisheries might be further developed, new methods of fishing experimented with and proper legislation passed in order to conserve the fishes of this state.

Accounts of its receipts and expenditures are published more frequently by this commission than by any other state board or commission. "California Fish and Game," published by the commission quarterly, contains a full statement of all money expended by this commission each month, besides an account of the commission's other activities.

That the funds of the commission have not been unwisely or extravagantly spent is proven by the results obtained. The salmon run, which in the early '80s was practically exterminated by mining operations, was restored by the work of the

commission's hatchery department, so that in 1918 over twelve million pounds of salmon were caught, which retailed at an average price of 25 cents per pound, making the total value of the catch $3,000,000.

Striped bass, catfish, black bass, shad, blue gill, calico bass and other food fishes were introduced into the waters of this state by the Fish and Game Commission. As a result of this work, 1,400,000 pounds of striped bass were caught in California in the year 1918. They were retailed at about 25 cents per pound, or $325,000. During the last three years over twelve million pounds of shad were taken in California, from thirty to sixty-five carloads of roe-shad being shipped to the Eastern markets each year, retailing at not less than 20 cents per pound, making an average of $800,000 per year.

Catfish are also caught in large numbers. In 1918, 200,000 pounds, worth 25 cents per pound, or $50,000, were sent to our markets. The annual catch of these four species of fish introduced or re-established by the Fish and Game Commission is valued at $4,175,000. In fact, a total of 250,000,000 pounds of fish were caught in California during the year 1918. The fish packed by canners and curers, alone, were worth approximately $20,000,000, to say nothing of the fresh fish sent to the markets.

Surely an industry of such magnitude is worth protecting, and any money spent in investigating the life history of our food fishes can not truthfully be said to be extravagantly spent without achieving results, particularly when the fish introduced, propagated and protected by the commission bring into the State of California, $4,175,000 per year—over ten times the amount expended by the state in the protection, propagation and conservation of all fish and game.

As a result of the investigations by the experts of the commission, a new season and limit was adopted and the catch of crabs increased 40,000 dozen per year, valued at $100,000.

Besides the important work of the Fish and Game Commission in propagating and conserving commercial fishes, it has also propagated and distributed millions of trout and has stocked many waters which had been entirely barren of fish life. Bear Lake, an artificial lake in San Bernardino County, about eight miles long, was stocked by the Fish and Game Commission. Hatcheries and egg-taking stations were built and maintained there and the supply of fish kept up so that now the fifty or sixty thousand people who visit the lake annually obtain excellent fishing. In addition to Bear Lake, the commission has also planted trout and black bass in Huntington Lake, Bass Lake, Shaver Lake, Clear Lake, Juniper Lake, Medicine Lake, Rea Lakes, Sixty Lake Basin and many other lakes throughout the Sierra Nevada and the Coast Range mountains, too numerous to mention. In all of these lakes excellent fishing is to be had and they are annually visited by tens of thousands of anglers.

Innumerable barren streams in the Sierra Nevada Mountains and elsewhere in this state have been stocked with trout. All of the streams in the Yosemite National Park above the floor of the valley were barren of fish life before they were stocked by the Fish and Game Commission. Golden trout have been distributed from Volcano Creek throughout the Sierra Nevada Mountains, as far north as the Yosemite Valley.

The fishing in some of our best streams is kept up solely through the work of the Fish and Game Commission. When the run of black-spotted trout, the only trout indigenous to the Truckee River, was stopped by the dams in the river in the State of Nevada, the Fish and Game Commission planted Rainbow, Eastern Brook and Loch Leven trout in this most excellent fishing stream, so that, now, while black-spotted trout are seldom, if every caught, excellent catches are made of the varieties introduced by the Commission.

The banks of the Sacramento River on Sundays and holidays, in fact, nearly every day, are lined with anglers fishing for catfish, crappie, blue gill, calico bass and other exotic fish introduced into the waters of this state by the Fish and Game Commission.

The work of the Fish and Game Commission in the protection of the game resources of the state has also been productive of excellent results. Deer are admittedly much more numerous now than they were ten or fifteen years ago. Cottontail rabbits are becoming so numerous that the residents of Fish and Game District No. 2 and Fish and Game District No. 4 have asked this Legislature that the protection given cottontail and brush rabbits be removed and that they be placed upon the list of predatory animals which may be taken at any time.

As a result of the protection given pheasants, those planted by the commission have become so numerous in favorable localities, that open seasons for the taking of these birds are demanded in Inyo and other counties and will probably be granted by this session of the Legislature.

Quail and doves are holding their own in most localities. Wild ducks and wild geese, under the protection given them both by the state and federal government, are so numerous that in many localities, they are considered a pest, particularly in the rice fields of the Sacramento Valley and the grain fields in the lower San Joaquin Valley. In fact, there is now pending in the Legislature a bill providing that the protection given ducks and geese be, to some extent, removed, in order that the farmers of the state may obtain relief from their depredations.

5. The diminution in the number of cases made in the biennial period 1916–1918, is due to the vigorous campaign of education being carried on by this commission. The commission feels that it can obtain much better results by educating the people to a proper observance of the laws for the conservation of our fish and game, than it can by arrests alone. Apparently the commission is justified in this. Despite the fact that the patrol has been more efficient than at any other time, the number of arrests have decreased from 2,087 in 1914–16 to 1,797 in 1916–18. Among the activities of the Department of Education and Publicity which emphasize the motto, "Conservation through education," are:

a. "CALIFORNIA FISH AND GAME," a quarterly magazine devoted to the conservation of fish and game in California, published, contains—

(1) Numerous articles on game species, means of identifying them, their past and present status and the means whereby they may be conserved.

(2) Statistics bearing on the abundance of game species.

(3) Reports of work accomplished by commission; activities initiated.

(4) Financial reports.

b. Publicity items in newspapers dealing with fish and game and the activities of the commission.

c. Magazine articles, *e.g.* "A New Goose for California," "Pernicious Bounty Laws."

d. Lectures on fish and game and its conservation illustrated with stereopticon and with motion pictures, given to schools, churches, teachers' institutes, boy scouts, summer camps, etc.

(1) Special series of lectures to university students.

e. Exhibits showing work and activities installed at State Fair and sportsmen shows.

f. Instruction relative to fish and game and the need and value of wild life conservation given in schools by means of lectures and trips afield.

(1) Teacher's bulletins issued furnishing teachers with usable information.

(2) Similar instructions given boy scout organizations at their summer camps.

g. Record of activities and accomplishments furnished the Governor and the people of the state through the medium of a biennial report.

h. Information on wild life furnished in reply to letters of inquiry.

The decrease in the number of cases can also be accounted for by the fact that at the 1917 Legislature, the sale of trout was prohibited, thus eliminating the many arrests that had theretofore been made of fishermen who caught trout for the market and who continually violated the law regarding both seasons and limits.

Furthermore, on account of the vigorous prosecution of cases by the commission, many violators have ceased to disobey the laws. For example, after Judge Murasky decided the case of *American Game Transfer* vs. *Fish and Game Commission* in favor of the commission, the merchants who had theretofore sold wild ducks illegally, practically quit doing so, and market hunters from whom they procured wild ducks discontinued their unlawful shipments.

6. At the urgent request of the anglers of southern California, the commission decided to build a hatchery to stock the streams and lakes of southern California and the western and eastern slopes of the southern Sierra Nevada Mountains, which were fished annually by thousands of people from Los Angeles and other portions of southern California. It emphatically and repeatedly demanded in writing of the Department of Engineering and Board of Control that the building should not cost more than $30,000. Plans and estimates were submitted by the State Architect, calling for a building to cost $29,500.

At a meeting held in the office of the Fish and Game Commission in the Mills Building, San Francisco, attended by John Francis Neylan, then President of the Board of Control; Mr. Dean of the State Architect's office; Frank M. Newbert, M. J. Connell, Carl Westerfeld, Fish and Game Commissioners; Ernest Schaeffle, Secretary of the Fish and Game Commission, and Mr. W. H. Shebley, Superintendent of Hatcheries, the commissioners attempted to question the representatives of the State Architect on the estimates submitted and were told emphatically by Mr. Neylan that neither he nor the representatives of the State Architect or the Department of Engineering or its officials, came to the commission to have their ability to estimate the cost of a building questioned by laymen; that the law provided that the amount set aside for the building must be turned over to the Department of Engineering and that if the plans were satisfactory, the commission would have nothing further to say about its construction. Furthermore, if the commission did not turn over $30,000 to the Department of Engineering, as provided by law, the Board of Control would not approve of the expenditure of one cent and the commission could not build the hatchery. Thereupon, the commissioners turned over $30,000 to the Department of Engineering, which assumed full charge of the construction of the building.

Before asking for plans and specifications for the hatchery to be built in Inyo County the Fish and Game Commission made an extended survey of all the streams in southern California, in order to obtain the best site possible for a hatchery. The temperature of the waters of numerous creeks was taken; the minimum and maximum

flow determined; the transportation facilities were examined; the needs of the surrounding country were investigated. After a most exhaustive examination, the present site on Oak Creek was chosen, and the results have fully justified the choice made. In view of the fact that nearly all the water in southern California was appropriated for irrigation, power or domestic use, the state was extremely fortunate to obtain such valuable water rights free of cost. These alone are of much greater value than the cost of the hatchery.

The fish produced at the Mt. Whitney Hatchery show much greater and better development than those propagated at any other in this state or anywhere in the world. The facilities for stocking the waters of the southern Sierras and southern California are better than those that could be obtained anywhere else in that section of the state and the people who are informed, are all of the opinion that no better site could have been chosen.

a. It is not true, as stated in the resolution, that there were no waters nearby needing to be stocked. On the contrary, there are numerous streams and lakes both on the western and eastern side of the southern Sierras, some of which are barren of fish life, in which trout ought to be planted. The headwaters of many of the streams flowing into the southern San Joaquin Valley rise in the western slopes of the Sierra Nevada, within easy range of the Mt. Whitney Hatchery.

b. It is not true that it is impossible to obtain a sufficient supply of trout eggs in the vicinity of the hatchery. On the contrary, an ample supply of trout eggs can be obtained from Rae Lake and Bear Lake, besides a bountiful supply of golden trout eggs from Cottonwood Lake, the only place in the world where these eggs can be obtained. In any event, it is much cheaper and easier to transport eggs to Mt. Whitney Hatchery to be hatched and distributed than it is to transport trout fry from Mt. Sisson Hatchery to the streams and lakes stocked from the Mt. Whitney Hatchery.

c. It is not true that the hatchery product must be transported a great distance or at a heavy expense. The lakes and streams of the southern Sierras and southern California can be easily reached and cheaply stocked from the Mt. Whitney Hatchery.

d. The hatchery product is loaded on the fish distribution cars at Owenyo, leaves there about five o'clock in the evening, and passing through the Mojave Desert at night, reaches Los Angeles and the southern portion of the San Joaquin Valley early the following morning.

7. The cost of maintenance and operation of the Mt. Whitney Hatchery is not extravagantly expensive nor out of all proportion to the benefit derived by the people of the state. From year to year the expense, instead of growing, will diminish on account of better facilities and the probable decrease in the price of food for fish.

The ground on which the hatchery is located was not purchased by the state, but was given to the state by the citizens of Inyo County. The commissioners are not aware who are the owners of the property adjacent to the hatchery site. At the time the hatchery was built, the land adjoining it immediately on the west was a part of the National Forest, owned by the United States.

The Fish and Game Commission of California has made a greater effort than any other state in the union to obtain accurate first-hand information relative to the present status and condition of the game and fish of the state. It has caused extended scientific research to be made, both as to the life histories of our game and our fishes.

Under the direction of Dr. H. C. Bryant and J. S. Hunter, the following investigations have been instituted:

a. Researches are being carried on by H. C. Bryant, Ph.D., game expert of the commission, and J. S. Hunter, in close co-operation with the University of California, Museum of Vertebrate Zoology, facilities and advice of the trained scientists of the university being available and used

b. Dr. Bryant, joint author of "The Game Birds of California," a 600-page book, published in 1918, detailing the life history, habits and past and present status of each species of game bird found in the State, sums up present knowledge of each species.

c. Investigations of the food habits of birds:

(1) Roadrunner proved an efficient destroyer of insect pests rather than an enemy of quail. Actual food consumed shown by stomach analysis.

(2) Study of food of ducks in progress. Will furnish information as to their relation to agriculture and will give evidence as to best food plants to attract wild fowl to the State. Natural foods suitable for use by the game breeder will also be apparent.

d. Compilation of dependable facts regarding game and its status. File kept; information furnished by forest officers codified; newspaper articles authenticated.

(1) Special report on fur bearing mammals; past and present status.

(2) Present status of beaver with map showing known distribution.

(3) Present status of prong-horned antelope with map showing present distribution and census of existing herds.

e. Statistics of annual kill of game.

(1) Deer. Estimate made from actual report of kill made by deputies and forest officers.

(2) Ducks. Estimate made from records showing shipments to market.

f. Investigations of disease attacking game.

(1) F. C. Clarke—disease attacking deer in Trinity County; proved to be a bladder worm.

(2) Dr. Bryant—disease attacking ducks in Sutter County, 1918.

g. Investigations of birds in relation to agriculture.

(1) Ducks versus rice. Joint investigation by Biological Survey and Fish and Game Commission.

(2) Blackbirds versus corn and other crops.

(3) English sparrow versus garden crops and beneficial native birds.

(4) Relation of meadow lark to agriculture.

h. Field investigations of game refuges.

(1) Trinity County Game Refuge; present condition; predatory mammals.

(2) Pinnacles Monument Game Refuge; present condition; predatory mammals.

i. Study of acclimatization of exotic species. Success and failure in the introduction of foreign game birds and mammals.

j. Study of methods of conserving wild life.

k. Scientific investigations of deer and their status in California by F. C. Clarke.

The following scientific investigations of the commercial fisheries of the state have been carried on, and many of them are still in progress under the direction of Mr. N. B. Scofield, in charge of the Department of Commercial Fisheries.

a. Investigation of Albacore, Sardine and Herring. Mr. Will F. Thompson, formerly with the Department of Fisheries of British Columbia, at present fishery expert in our laboratory at Long Beach, is making a scientific investigation of the life history of the albacore, together with a statistical analysis of the catch. He is also making a scientific study of the sardine and herring, as well as observations on a great many other fish. The greater part of the time, however, is spent with the albacore and sardine, in order that we may be prepared to cope with the many problems arising with the rapid development of these fisheries.

Mr. Elmer Higgins, who is a graduate of the Department of Zoology, University of Southern California, is assisting Mr. Thompson in the laboratory, collecting specimens and conducting experimental fishing trips on the patrol launch "Albacore."

b. Edwin Chapen Starks, assistant professor of zoology of the Leland Stanford Junior University (formerly curator of the museum, and instructor at the University of Washington), is writing a series of comprehensive articles on the results of his studies of the various fishes of this coast, which appear in our magazine, "CALIFORNIA FISH AND GAME," *i.e.*,

The Flat Fishes of California.
The Mackerel and Mackerel-like Fishes of California.
The Herring and Herring-like Fishes of California.
The Sharks of California.
The Skates and Rays of California.

c. Salmon. Arrangements have been made to complete the investigations of the life history of the salmon from Monterey Bay to the northern boundary of the state. Mr. Willis Rich, a well-known student in zoology, and J. O. Snyder, associate professor of zoology, Leland Stanford Junior University, formerly Assistant United States Fish Commissioner, naturalist U. S. S. "Albatross" and expert ichthyologist, will carry on the work. Mr. Rich has already completed a great deal of work on the salmon and Dr. C. H. Gilbert of Leland Stanford Junior University has carried on extensive experiments for the commission in marking and planting salmon fry.

d. Crab. A study of the Pacific Coast edible crab (*Cancer magister*) was made by Frank Walter Weymouth (assistant professor of physiology, Leland Stanford Junior University, A. B. Stanford 1909, A. M. Stanford 1911. In 1912 and 1913, assistant in physiology at the Johns Hopkins University), in the year 1911. As a direct result of his findings the size limit of crabs was increased by law and the catch of crabs in 1917 was increased 50 per cent over that of 1916.

e. Mollusks. In 1911 a complete survey was made of the California coast under the direction of Prof. Harold Heath, professor of zoology, Leland Stanford Junior University (A. B. Ohio Wesleyan, Ph.D. Pennsylvania), covering the mollusks of this region. W. W. Curtner, Will F. Thompson and Mr. Hubbs assisted in this work.

f. Crawfish. A crawfish investigation was made in 1911 by Bennett M. Allen of the University of Wisconsin. Later Waldo S. Schmidt of the United States National Museum came to this coast, and in 1918, with the assistance of our men and boats, was able to secure some specimens of young crawfish which will greatly assist him in his report of their life history.

g. Abalones. Mr. W. W. Curtner has made a complete study of the abalones of the State. Mr. Curtner is a graduate in zoology of the Leland Stanford Junior University.

h. Striped Bass, Sturgeon, Perch, Shrimps, etc. Mr. Scofield has himself conducted a great many investigations of our fishes, such as the shad, striped bass, perch, sturgeon, etc. He has also made a study of the shrimp fishery and has been able to prevent the use of the destructive Chinese method of shrimp fishing.

i. Kelp. During the Great War, when a sufficient amount of potash was not obtainable even at the increased price of $300 and $400 a ton, formerly $65 per ton, a study was made of the extensive kelp beds along the coast of southern California with the assistance of Mr. W. C. Crandall of the Scripps Institution and Dr. F. W. Turrentine of the United States Department of Agriculture, and regulations were made as a result of this study which enabled the harvesters to cut the kelp to the limit without unduly destroying the beds.

9. There is less than eight miles of the Truckee River in California below Floriston. Shortly before the present Board of Fish and Game Commissioners was appointed, the State of Nevada appropriated $10,000 to abate the nuisance caused by the pollution of the Truckee River at Floriston. Nevada's chief complaint was not that the alleged pollution was deleterious to fish life but that it rendered the water supply of the city of Reno unpalatable.

An action was commenced by the State of Nevada in the United States courts in San Francisco and much testimony was taken. It was not proven that the refuse was deleterious to fish. In fact, the testimony showed that the fish in the river below the point at which the refuse was discharged, were in good condition and fit for human consumption. The action commenced by the State of Nevada was thrown out of court. Thereafter, certain state officials of Nevada consulted with the Fish and Game Commission of California, with a view to abating the nuisance. F. A. Shebley and N. B. Scofield were sent by the commission to the Truckee River to make further experiments with the water affected. Numerous conferences were held and a committee consisting of W. H. Shebley, Superintendent of Hatcheries in California, Professor Dinsmore, Bureau of Chemistry, University of Nevada, and Mr. Block, representing the paper company, was appointed to go east at the expense of the paper company to investigate certain appliances to handle the refuse. The owners of the paper company agreed to install these appliances providing the manufacturers thereof would guarantee their efficacy. When the manufacturers would not do this, the matter was again taken up by Governor Boyle of Nevada and Mr. Thatcher, Attorney General of Nevada, with Governor Hiram W. Johnson of California, and Mr. Westerfeld.

As a result of this conference, a committee consisting of Hon. Arthur Arlett and W. H. Shebley, again investigated the condition of the river below Floriston and made its report to Governor Johnson. Mr. Westerfeld thereafter wrote Governor Johnson, asking that the Attorney General of the State of California be instructed to commence proceedings under the authority of *People* vs. *Truckee Lumber Company*, 116 Cal. 397, against the paper company to abate the nuisance. At the next session of the Nevada Legislature, another appropriation was granted by that state to again commence proceedings against the paper company. An action was thereupon instituted and is now pending in the Supreme Court of the United States.

10. Water Pollution. Practically nothing was done by previous boards of Fish and Game Commissioners to prevent pollution of the waters of the state. The present board has, however, made great strides in this work and it is safe to say that California now leads any other state in the Union in preventing the pollution of its waters.

In the last ten years many complaints have been filed in the courts against large corporations and individuals to stop the discharge of refuse matters into the waters of the state and vast sums of money have been expended by them in order to remedy the evil. For example, as a result of complaints filed in the courts by the Fish and Game Commission, the following named companies have expended the amounts set opposite their respective names to prevent pollution:

Pacific Gas and Electric Company	$200,000 00
Union Oil Company	18,000 00
Shell Company of California	40,000 00
Doheny-Pacific Petroleum Company and Associated Oil Company, jointly	20,000 00
Mason Malt Whiskey and Distilling Company	7,000 00
Southern Pacific Company	23,000 00
Monarch Refining Company	5,000 00
American Oriental Refining Company	2,000 00
Capitol Refining Company	1,000 00
Paraffine Paint Company	1,000 00
California Petroleum Company	1,200 00
Total	$318,200 00

Many fines have also been collected as a result of prosecutions commenced by the commission.

Other large companies which have complied with our requests, or demands, without prosecution, are as follows:

Standard Oil Company	$500,000 00
Southern Pacific Company	26,000 00
Northwestern Pacific Railroad Company	5,000 00
Coast Counties Gas and Electric Company	5,000 00
Coast Valleys Gas and Electric Company	3,000 00
Pacific States Refining Company	2,000 00
Atchison, Topeka and Santa Fe Railroad Company	2,000 00
Western States Gas and Electric Company	5,000 00
	$548,000 00
Brought forward	318,000 00
Grand total	$866,000 00

And in addition a large number of smaller companies and individuals have been compelled to cease pollution where such existed. In all cases where persons, firms or corporations have failed to comply with our demands they have been taken into court.

Three cases are now pending in the courts of San Luis Obispo County, two against the Union Oil Company for pollution of San Luis Bay, and one against the Tiber Pacific Company.

11. Screens. Prior to 1912 no systematic effort was made to cause the installation of screens and ladders. At that time the present commission created a department of screens and ladders and detailed two men to attend to this work under the supervision of the Superintendent of Hatcheries. Since that time, despite the fact that the law has been found defective in some respects, 862 surveys have been made and notices served on the owners of ditches to install suitable screens. At this date 518 screens have been reported as being installed and in effective working condition. Before May 15 of this year between fifty and sixty screens have been installed at the expense of several thousand dollars. For instance, the screens installed by the Sacramento-West Side Canal Company, the Anderson-Cottonwood Irrigation Company and the Southern California Edison Company, cost many thousands of dollars each.

The work of installing screens in ditches is being pushed as rapidly and as vigorously as conditions will permit.

Under the law as amended in 1917, at the suggestion of the commission, the California Oregon Power Company has, at an expense of $20,000, built a hatchery at the Copco dam on the Klamath River, and last month conveyed it to the state, together with dwellings, traps and other equipment necessary to operate the station.

12. Ladders. The present Fish and Game Commission in 1912 began a systematic survey in order to determine where fish ladders should be installed. As stated under the head of "Screens" (point 11), two men were detailed under the supervision of the Hatchery Superintendent to make these surveys and to draft plans to be given the owners or occupiers of the dam. Numerous ladders and screens were installed; under the law 47 hearings as to the necessity of the installation of screens and ladders were held by the commission and findings made and orders issued by the board compelling the installation of fishways and screens. To date a total of 209 surveys of dams have been made and the owners have been legally notified to install fish ladders in accordance with the plans submitted. Of this number 131 fishways have been constructed and have been accepted as being effective. The other cases are being pushed vigorously and in some instances actions have been commenced to compel obedience to the orders of the board.

13. At the 1917 session of the Legislature, the commission was instrumental in having sixteen large areas within national forests set aside as game refuges, aggregating 839,180 acres. Besides this, the commission has now established seven game refuges on privately owned land in sections where hunting is intensive and game needed such protection. Within the last six months, over 60,000 acres of private holdings have been set aside for this purpose.

The commission is now asking the Legislature that two new game refuges be created, one around Lick Observatory, the other in Kern County.

14. The branch office established at Fresno was abolished because the work done by that office could be more efficiently and economically handled by the San Francisco office. The officer who had been in charge of the Fresno office was retained in the service of the commission until he voluntarily asked to be given a furlough in order that he could operate a mine which he owned and also attend to his agricultural interests which demanded his attention.

15. The game farm at Hayward, California, was established in 1908, prior to the appointment of the present board. The grounds were leased for a period of ten years. This commission was willing to cancel the lease at any time, had it been able to make suitable terms with the owner. When the owner of the land sued the commission to

set aside the lease, the commission put in practically no defense, but Judge Murphy, who tried the case, nevertheless ordered the commission to maintain a game farm on the land until the expiration of the lease.

16. It is not true that the distribution of fish as carried on by the commission is unscientific, unduly expensive or that it results in the destruction in each year of a large portion of the fish so distributed.

Through the efforts of the commission, two fish cars, distributing fish all over the State of California, are hauled free of charge by the railroad. The greatest of care is taken to see that the fish are properly distributed and properly planted in the streams and lakes.

17. It is not true that the Fish and Game Commission failed to investigate the young salmon propagated and distributed in the Sacramento River. The Fish and Game Commission has heretofore caused such investigation to be carried on by Dr. C. H. Gilbert of the Stanford University and Mr. N. B. Scofield, fishery expert for the commission, and is now carrying on such investigation in conjunction with the Bureau of Fisheries under the direction of Mr. Willis Rich and Mr. J. O. Snyder of the Stanford University, Mr. N. B. Scofield and Mr. W. H. Shebley. Salmon fry are held longer at Mt. Shasta Hatchery and are larger when released than those reared by any other state or county.

18. The commission has not at any time been governed for political or personal or other inefficient or improper motives.

a. It has not dismissed trained or efficient employees without cause.

b. It has not employed or promoted or otherwise rewarded assistants or employees not deserving of such consideration.

c. The department is not demoralized or functioning inefficiently or at an expense out of all proportion to the results obtained. On the contrary, the work of the department is now being performed more efficiently, intelligently and economically than at any other time during its existence.

19. The force of wardens in the field is as great as the funds of the commission will permit. If the overhead has increased, it is caused by the increase of the clerical work connected with the commission's activities, and also by the rules and regulations laid down by the Board of Control.

Respectfully submitted.

FISH AND GAME COMMISSION.
CARL WESTERFELD, *Executive Officer.*

Fig 56. Yosemite Valley deer photographed in a snowstorm. Snow was falling at the rate of two inches an hour when these deer were photographed by A. M. Fairfield, March 6, 1919. Exposure 1/25 sec., stop, F 6.3.

CALIFORNIA FISH AND GAME

A publication devoted to the conservation of wild life and published quarterly by the California State Fish and Game Commission.

Sent free to citizens of the State of California. Offered in exchange for ornithological, mammalogical and similar periodicals.

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All material for publication should be sent to H. C. Bryant, Museum of Vertebrate Zoology, Berkeley, Cal.

October 21, 1919.

PERSUASION VERSUS COMPULSION IN FISH AND GAME CONSERVATION.

Legislati n is the time-honored method by which the body politic attempts to attain an object. When new roads are desired, the legislature is asked to enact the proper laws. When the public health is to be safeguarded, an act of the legislature is demanded. But beyond the mere placing of a law on the statute books is the necessity of making the law effective by means of law enforcement. Where the need for the laws is well realized there is little need of law enforcement; where they are poorly understood, time, energy and money must be spent to attain the object sought.

When, in fish and game conservation, we turn to this same time-honored method, the difficulties are just begun, for laws passed by the legislature must be enforced. Because of the failure of peace officers to do their duty, a large number of specially appointed game wardens must force people to obey the law.

Is there not a better way of attaining the same object? More and more we find campaigns of education being instituted to prepare the way for proper legislation. A city does not think of holding a bond election until after the people have been educated to the need for which the bonds are to be issued. Successful liberty loans have been effected by proper publicity almost to a greater extent than by the actual systematic canvass. The best example of accomplishment by means of an educational method rather than a legislative method is to be found in the success of the United States Food Administration.

How much better to have attained the goal by means of persuasion rather than compulsion!

If it is evident in attaining an object that the educational is of more worth than the legislative method because more fundamental, it seems reasonable that more time and energy should be devoted to this method in attempting the conservation of natural resources.

THE ANGLER VERSUS THE NET FISHERMAN.

The old controversy between the angler for sport only and the net fishermen for profit only, over the waters adjacent to Santa Catalina Island, has been revived recently.

It was thought that this matter had been definitely settled by action of the 1917 legislature in making two districts around the island, one in which net fishermen could operate and one for the benefit of the sportsmen only.

The promise of the cannery interests and net fishermen that they would not operate in a district dedicated to the sportsmen, provided a certain part of the waters surrounding the island be made a district in which net fishing should be permitted, would certainly seem to have settled the matter. However, it appears that this gentleman's agreement was not considered binding by some of the contracting parties.

About the middle of August, twenty-two canneries operating around San Pedro and some 340-odd alien fishermen who, not being able to maintain an action in the state court, cloaked themselves under the protecting wing of the canneries, obtained from the presiding judge of the Superior Court of Los Angeles County an order restraining certain individuals from interfering with their nets and boats, and further restraining them from making searches and seizures. This order was petitioned for under the plea that irreparable damage would be caused by the action of these certain named defendants, operating without due process of law.

The order was granted without previous notice to any of the defendants named in the petition. No mention was made in the petition that all of these

defendants were officers of the law, sworn to enforce the law, and that the actions complained of were performed in the pursuance of their duties.

The restraining order was served on H. B. Nidever, W. B. Sellmer and E. L. Hedderly, but no order was served at that time on the Fish and Game Commission. The order was also served on Ernest Windle, justice of the peace of Avalon township, Bates and Sutermeir, respectively deputy county warden and constable of Avalon township.

The hearing of the petition to make permanent the temporary injunction was held before Judge Valentine on August 19, 1919. The attorneys representing the plaintiffs in the action attacked the constitutionality of section 636 of the Penal Code, relating to nets, and also the description of District 20, as given in the act dividing the state into fish and game districts. They maintained that since the acts were void, the court had the right to restrain the public officers from enforcing the provisions of section 636. They also maintained that the state had no jurisdiction over the waters surrounding Santa Catalina Island, because the state constitution made no mention of a three-mile limit around the island. This latter contention was shown to be so absurd that it has since been abandoned.

The court took the stand that since a temporary order had been granted, it was up to the defendants to show cause why it should not be continued and made permanent. The defendants were given five days in which to present their opening briefs; the plaintiffs were given five additional days for reply, and the defendants were allowed five days further for their closing briefs. By this, it can be seen that the cannery interests gained fifteen additional days in which to make raids on the fishing grounds in District 20.

Immediately after the hearing, an order was served on the Fish and Game Commission restraining it from enforcing the law relating to net fishing in the waters around Catalina Island.

It is of interest to note, however, from the report of our deputies, that the fishermen have gained very little by their tactics, as their fishing operations have produced very poor results.

Judge Valentine having set aside the temporary restraining order September 10, 1919, the Fish and Game Commission has given instructions to its deputies to enforce the law in District 20. For the time being, it would seem that this decision in favor of the commission's contentions will effectually settle the controversy.—E. C. B.

Fig. 57. Children on a nature study field excursion, Al Tahoe, evidence of the success of the educational work carried on by the Fish and Game Commission in summer resorts this past summer.

EDUCATIONAL WORK IN SUMMER RESORTS.

The attempt to stimulate interest in wild life by carrying the Fish and Game Commission's educational campaign into the summer resorts proved very successful. During the month of July Doctor Bryant visited five of the largest resorts on Lake Tahoe: Brockway, Tahoe Tavern, Emerald Bay Camp, Al Tahoe Inn and Fallen Leaf Lodge. Lectures illustrated with stereopticon and motion pictures were given in the evening and parties taken afield in the day time. Of particular interest were the groups of children who roamed the woods and stream sides searching for wild things. It would be difficult to estimate the value of these excursions when the public at leisure came in contact with nature and learned the fundamentals of conservation first hand.

The final report shows that thousands of people were reached through the medium of lectures and that hundreds received instruction from a nature guide. The nature study reference books furnished by the California Nature Study League were in great demand and greatly helped in awakening interest in wild things.

It will be of interest to our readers to know that the Department of the Interior has decided to employ in each national park a resident naturalist whose duty it will be to answer questions and to interest people in the out-of-doors. Thus will the government augment the work already started by the commission.

The summer resort work at Tahoe proved so popular that an expansion of the work another summer will be demanded. There is no surer way of stimulating interest in wild life conservation than to develop interest in the out-of-doors when people are most susceptible to information about it.

Fig. 58. "Learning to read a roadside" at Emerald Bay under the instruction of a nature guide furnished by the Fish and Game Commission. An experiment in making conservationists out of the summer vacationists.

TAHOE PUBLIC CAMP.

The legislature at its last session set aside the old hatchery grounds at Tahoe City, which are to be abandoned for a better site, as a public camp for vacationists. Under the direction of the Fish and Game Commission the State Engineering Department installed a water supply, sewer system and other sanitary conveniences. The camp was opened to the public on July 4 with Mr. Arnold D. Patterson as superintendent. On the first day over a hundred campers were cared

for. The camp remained open until September 5. During the season 1,239 persons registered, but this number does not represent the total number accommodated. Further improvements are to be made in preparation for the crowds expected next summer.

and providing for a bag limit of one deer. Governor Smith, in signing the bill, stated that the law was in the nature of an experiment and that if it proved unsatisfactory it would be repealed.

Laws of this character, contrary to recommendations of those most interested

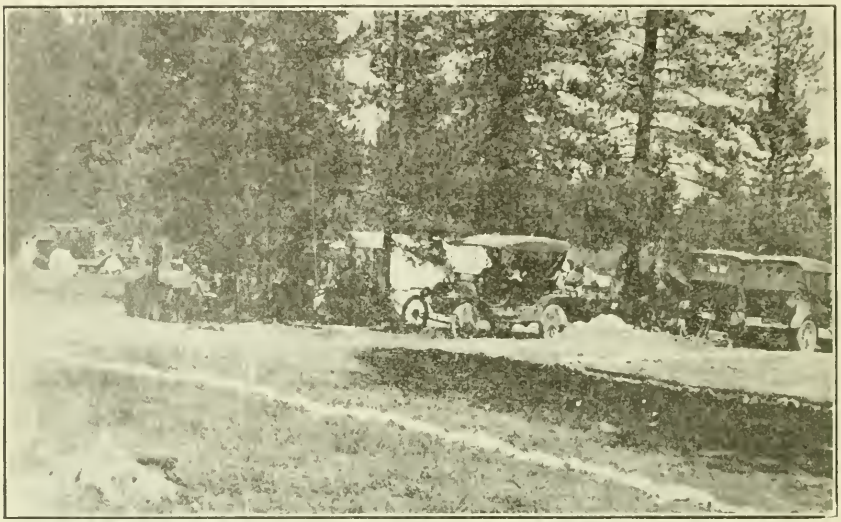

Fig. 59. Tahoe Public Camp on the old hatchery grounds at Tahoe City. Hundreds of campers availed themselves of the comforts of this free camp ground conducted by the Fish and Game Commission. Photograph by George Neale.

DEER CONSERVATION IN NEW YORK.

The state of New York is gaining some valuable facts by obtaining a census of the deer. The reports lead to a conclusion that there are in round numbers about 50,000 deer in that state. In 1917, approximately 37,000 men hunted deer and the total deer killed is estimated at 10,000. Records show that 5,888 Adirondack deer hides were received for tanning by different tanning companies.

Approximately 19,000 of the total number of deer are bucks. With a kill of 10,000 about 50 per cent of the bucks are killed each year. This is a toll already too great if the deer supply is to be maintained.

As a result of investigations a shorter season and a bag limit of one buck instead of two was recommended, but the legislature, influenced by selfish hunters, passed a bill allowing the killing of "any wild deer of either sex, other than fawns," in game conservation and contrary to the best experience of other states, are likely to prove costly experiments.

MIGRATORY BIRD TREATY ACT CONSTITUTIONAL.

The duck shooters of the country who have fought federal protection for migratory birds in an effort to defeat the law so that they might continue the destructive practice of spring shooting of waterfowl, have been decisively beaten on two occasions lately in the United States District Courts. This fact is made more interesting because on both occasions those opposing the law felt certain they would win. Their array of counsel was the best they could obtain. They chose their cases with due regard to decisions made in the past and with all respect to the local sentiment in the district where the trial was held. In fact, they left no stone unturned that would aid them in their fight to defeat the law, and still they

lost. The sportsmen of the country should feel highly pleased over their victory, for surely the law is valid or the organized fight against it would have met with at least some slight success.

On June 4, 1919 United States District Judge Jacob Trieber, of the Eastern District of Arkansas, who held that the original migratory bird law of 1913 was unconstitutional, handed down a very sweeping decision upholding the new law. This was the first jolt received by the spring shooters, but the knockout blow came later at Kansas City, Missouri, when Judge Arba S. Van Valkenburgh, on July 2, 1919, upheld the law in a decision so sweeping that a fitting comparison is Dempsey's decision over Willard a few days later.—*Bull. American Game Protective Association.*

WATERFOWL DIE FROM EATING SHOT.

Wild ducks and other waterfowl sometimes die from lead poisoning resulting from swallowing stray shot which they pick out of the mud about shooting grounds. Many ducks that become sick from lead poisoning finally recover, but it is probable that the effect is permanently injurious not only to the individual but to the species. It has been ascertained by experiment that lead greatly impairs the virility of male domestic fowls. Females mated with them lay many infertile egs, while in many of the eggs that are fertilized the embryo dies in the shell or the chick emerges weak and unable to withstand the hardships of early life. What effect lead poisoning has on female wild fowl has not been definitely ascertained, but, as the fact is well known that lead produces abortion in female mammals, there is a possibility that it exerts a bad effect on female waterfowl during the breeding season. Thus, the supply of waterfowl is likely to be decreased by lead poisoning not only by the number of birds that die directly from it but indirectly by impairment of reproduction.

These facts are set forth by the United States Department of Agriculture in Bulletin 793, "Lead Poisoning in Waterfowl," about to be published as a contribution from the Bureau of Biological Survey. Reports of waterfowl apparently sick from lead poisoning have been coming in for several years. The Biological Survey undertook an investigation at various shooting grounds to determine how common the taking of shot by waterfowl is, and a series of experiments to ascertain the effect of shot swallowed. It was found that at places where much shooting is regularly done from blinds, shot at the bottom of the shallow water are so numerous that one or more was found in practically every sieveful of mud or silt, and that they are swallowed by waterfowl whenever found as a result of this habit of swallowing small, hard objects to supply grit for the gizzard.

The experiments have shown that shot swallowed are gradually ground away in the gizzard and pass into the intestines, producing a poisoning that results in progressive paralysis and, usually, death. Experiments with wild waterfowl captured when young and reared in captivity—to obviate the possibility of their having taken lead before the beginning of the experiments—have shown that six pellets of No. 6 shot constitute an amount of lead that is always fatal. Two or three shot were sufficient to cause death in several instances. In one experiment, two mallards were given one No. 6 shot each. One of them died in nine days and the other was able to throw off the poison.

The list of species known to have been poisoned by eating shot consists of mallard, pintail and canvas-back ducks, the whistling swan, and the marbled godwit, but many other species, particularly of ducks and geese, are undoubtedly affected by it, according to the bulletin.

Unfortunately, nothing can be done at this time to protect waterfowl from lead poisoning except to call attention to the malady and to make known its cause and symptoms. The department, however, desires statistics on the numbers and species of birds affected and asks that sportsmen and others report to the Bureau of Biological Survey all cases that come to their attention.

GOVERNMENT NEEDS DEPUTY CHIEF GAME WARDEN.

The United States Department of Agriculture is in need of a well-qualified man, not less than twenty-five nor more than forty-five years of age, to fill a vacancy in the position of deputy chief United States game warden, and the United

States Civil Service Commission will give a most practical open competitive test to secure the right man. The entrance salary will be between $2,500 and $3,000 a year. Headquarters will be in Washington, D. C.

The duties of the position are to assist in administering the law which gives effect to the treaty between the United States and Great Britain for the protection of migratory birds and the sections of the United States Penal Code known as the Lacey act; in the supervision of United States game wardens and deputies in the gathering of evidence and the preparation of cases for prosecution of alleged violations of the federal game laws, and in office administration; and to participate in conferences in and out of Washington with individuals and organizations interested in wild life conservation.

In accordance with its practice in connection with positions of this class, the examination given by the Civil Service Commission will not require the applicants to appear in an examination room for a mental test. Those who apply will receive a rating on their education and practical experience, weighted at 80 per cent, and on a thesis on a selected game-conservation subject, weighted at 20 per cent. Those who attain a passing grade will later be given an oral test to determine their personal qualifications for the position. Failure in this oral test will render the applicant ineligible for appointment.

Applications will be received by the Civil Service Commission up to and including October 28. Full information and application blanks may be obtained from the secretary of the local board of civil service examiners at the post office or customhouse in any of 3,000 cities, or by writing to the United States Civil Service Commission, Washington, D. C.

ANGLERS, ATTENTION.

At last we have landed the articles on angling you have been looking for. All of the fine points of angling will be discussed. Read the first of the series which treats of dry-fly fishing on page 169 of this issue and watch for the other articles in the series furnished by "R. L. M., California," than whom there is no better writer on the subject.

ADDITIONAL MIGRATORY BIRD TREATIES NEEDED.

In order to complete our program for the protection of migratory birds, it is as necessary for them to be protected in the countries in which they sojourn during winter months as in the territory where they breed and spend their time in spring, summer and autumn.

It is therefore imperative that treaties be entered into with the republics of Mexico, Central and South America for the protection of birds that, in the course of their annual migration, pass from or through the United States and temporarily sojourn in such countries. It is a startling fact that wild duck are slaughtered by the millions in Mexico by pothunters, many of whom use masked batteries, and that they are sold in the markets for the pitiful sum of three cents each.

It is regrettable that the republics lying to the south of the United States have no game laws, but in the event those countries enter into treaties with the United States government for the protection of migratory birds, in order to carry out the terms of such treaties, such countries will be required to enact and to enforce laws making such treaties effective.

A campaign of education should be at once inaugurated in the Latin-American republics for the purpose of bringing to the attention of the people the economic value of birds and game, and the relation of these resources to the comfort, happiness and recreation of man.

The question is, can the migratory wild life withstand the onslaughts made upon it for mercenary purposes by irresponsible individuals in the Latin American republics, without being subjected to certain depletion and ultimate extinction?

Should the sportsmen of the country concur in the views briefly set out in this short paper, let them bestir themselves by addressing communications to their members of congress, and urging their active influence and assistance in making the treaties between the United States and the Latin-American republics, for the protection of migratory birds, an accomplished fact.—JOHN H. WALLACE, Commissioner, Dept. Game and Fish, Montgomery, Alabama.

STATE FAIR EXHIBIT.

The Fish and Game Commission's exhibit at the State Fair at Sacramento, August 30 to September 9, 1919, was the most pretentious yet attempted and proved to be the biggest attraction at the fair. A capable engineer was retained to draw the plans and Mr. Wm. F. Dabelstein, an artist of San Francisco, executed them. The whole north end of the new Agriculture Building was given over to the exhibit. The main feature of the exhibit was a cyclorama of the Sierras with Mounts Shasta, Lassen and Whitney looming up in the background and in the foreground the south end of Lake Tahoe

Fig. 60. The Fish and Game Commission's exhibit at the State Fair at Sacramento which took the form of a panorama of the High Sierras with Mount Shasta and Lake Tahoe at the left and Mount Whitney with a miniature of the Mount Whitney Hatchery at its base at the right. The exhibit was pronounced the finest on the fair grounds.

at one end and a miniature of the Mount Whitney Hatchery at the other. Several miniature waterfalls tumbled down the rocks into an artificial lake filled with trout. The whole scene was made still more attractive by a system of lighting which successively showed the gray light of dawn, the rosy tints of sunrise and the light of full day.

Arranged in front of the panorama were four large aquaria. Two of them showed common introduced fish such as black and striped bass, blue-gilled sunfish, crappie and catfish, a third showed different varieties of trout and a fourth was filled with the famous golden trout of the Mount Whitney region. Great interest was shown in the golden trout, and no wonder, for their bright colors would attract anyone. The hardiness of this variety of trout was evidenced by their vigorous good health while in the aquarium. Not a fish was lost in transit, nor did one die during the ten days duration of the fair. The publications of the commission were on display and wild life films were shown in the motion picture theater twice daily.

GAME CENSUSES.

Many states are inaugurating a game census to determine the distribution and comparative abundance of different varieties. New York requires the wardens to report regularly on all game seen and also requires a report of the game taken, from each license holder. Minnesota has just inaugurated a similar census to be made by wardens. Although such censuses will doubtless give a basis for estimating the abundance of game, yet such reports are necessarily so inaccurate that California has not instituted similar work. It may be that at some future date California will follow the lead of these other states.

In the meantime J. S. Hunter, assistant executive officer, is contemplating a different sort of a census—one which would perhaps bring in more dependable data with less work. The number of cartridges sold in the state, if it were

Fig. 61. Posting a game refuge. Suitable signs now mark the boundaries of our refuges. Photograph by H. C. Bryant.

known, would allow an estimate of the game killed. Different sorts of cartridges are used for the different kinds of game birds and mammals and with due allowance for game missed the total kill could be approximated. The securing of data along these lines would not be as difficult as the requiring of reports from wardens and hunters.

HATCHERY DEPARTMENT MOVES.

The Fishcultural Department, headed by Mr. W. H. Shebley, has moved to Sacramento, where temporary offices have been established in the Forum Building pending the more commodious quarters being prepared in the new Capitol Building. All correspondence connected with the Hatchery Department should hereafter be addressed to Fish and Game Commission, Department of Fishculture, Forum Building, Sacramento.

COLORED PRINTS OF GOLDEN TROUT AVAILABLE.

A few copies of the beautiful lithograph of the golden trout which appeared as the frontispiece of the Trout Number of CALIFORNIA FISH AND GAME are available for distribution. Libraries and schools are urged to procure copies for framing. Send a two-cent stamp.

FACTS OF CURRENT INTEREST.

A number of aliens who have purchased citizens' hunting licenses have found that it does not pay. In each instance they have had their license confiscated and been made to pay a $50 fine.

Splendid fish have been reared at the Yosemite and Kaweah experimental hatcheries, thus demonstrating the feasibility of constructing permanent hatcheries at these stations.

State lion hunter J. Bruce recently succeeded in bagging four lions in Tuolumne County.

Plans are under way for a State Fisheries Laboratory to be located near San Pedro. This will furnish working quarters for the scientific staff of the Department of Commercial Fisheries and will give room for an educational exhibit showing the work of the department.

Nearly three-quarters of a million golden trout were successfully reared at the hatcheries this year. Most of them will be planted in the Southern High Sierras, but some will be placed in the Tahoe region.

So great was the demand for the Trout Number of **CALIFORNIA FISH AND GAME** with its colored plates that the supply is practically exhausted.

Hundreds of campers availed themselves of the public camp on the hatchery grounds near Tahoe City this past summer. It will be remembered that several acres of land were set aside for campers by the last legislature.

Several additional wardens have been employed this past summer to help patrol the state game refuges. Added protection has also been accorded by the eight aeroplane patrols established by the United States Forest Service.

Ducks are again dying from alkali poisoning in the Marysville Butte region of the Sacramento Valley.

COMMERCIAL FISHERY NOTES.

N. B. Scofield, Editor.

THE SALMON OF THE SACRAMENTO NEED MORE PROTECTION.

It is believed that the Sacramento salmon are not being adequately protected and that serious depletion may now be taking place. Within the last few years the salmon fisheries at Monterey and Point Reyes, which draw upon the Sacramento supply, have grown enormously, and as they have grown the catch on the Sacramento has been correspondingly less, in spite of the fact that the number of nets on the river has increased and that on account of the higher price the fishermen fish more persistently.

The present fall season on the Sacramento remains open at least two weeks too long. Several years ago the season closed on September 16. It was contended by fishermen and dealers that the salmon were running later each year and they succeeded in obtaining an open season until September 20. Later the season was continued until September 25. The object of the closed season is to protect at least one-third of the run in order that they may pass up the river unhindered by nets and cast their spawn in the headwaters and by so doing insure a continuous future supply of salmon. With the present season, one-third of the run is not protected, for by the closing date, September 25, the last of the run or so much of it as is left has passed the nets in San Francisco Bay, San Pablo Bay, Carquinez Straits and Suisun Bay, a distance, favorable for the use of nets, of nearly fifty miles. The salmon work up the bays and river slowly and after the run has passed the lower bays the fishermen move up and continue to catch them in the lower river until the season finally closes. The wonder is that any escape The salmon which have escaped make their way to the spawning grounds which are located mainly in the tributaries, Mill Creek, Battle Creek and McCloud River. In each of these tributaries a spawn-taking station is operated to collect salmon eggs for the hatcheries. The number of salmon reaching these stations is becoming less each year so that the number of eggs that may be taken is now only about one-fifth what it was only a few years ago. This decrease in the number of fish reaching the spawning grounds is a sure sign of overfishing and it is self evident the salmon should be protected from this overfishing.

The Sacramento also has a spring run of salmon or rather what is left of a once large spring run. The salmon of this run enter San Francisco Bay during the winter and early spring and after escaping the trollers outside they have to run the gauntlet of gill nets through the bays and the river as far up as Colusa. Above Colusa, as far as Vina, every place the river sweeps round a bend with a sandbar on the inside of the turn there is a seining outfit which periodically sweeps the deep hole where the salmon congregate preparatory to ascending the next shallow stretch of the river. There are some fifteen of these outfits operating on the "seining bars" on the upper river. And the salmon can not escape these seines which sweep the holes where they collect except during periods of very high water. On the river below Colusa and in the bays, there is no closed season to protect this spring run. On the river above Colusa the season closes May 15, but this date is so late the run is all but over.

There is no salmon stream in North America where nets are allowed for so great a distance up the stream as on the Sacramento. The number of salmon taken in these seines is not great, but they are the remnant of the spring run and they are a thousand times more valuable for propagating the species than for food. The hatchery of the United States Bureau of Fisheries at Baird on the McCloud River is the only hatchery which has collected spawn from the spring salmon run, but at this hatchery they have not attempted to take eggs from this run for the past six years for the reason the number of salmon reaching that point had become so small it was deemed insufficient to warrant the expense of operating.

Two things are quite obvious to anyone who knows the facts. Seining and gill netting in the upper river should be pro-

hibited and the fall season should close earlier so as to give some measure of protection to the larger and more important fall run. Trolling in the open sea possibly should be restricted. Investigations which were begun this year by the Fish and Game Commission under the direction of Dr. J. O. Snyder are expected to throw light on this point.

STRIPED BASS TAKEN IN MISSION BAY, SAN DIEGO COUNTY, CALIFORNIA.

Mr. A. G. Pearson of San Diego reports that on or about June 20, 1919, he took several small striped bass ranging from five to eight inches in length, in San Diego River near its outlet into Mission Bay.

On October 26, 1916, eighteen hundred small striped bass were planted near the mouth of San Diego River by the Fish and Game Commission, and since that time small striped bass have on several occasions been observed near the place of planting. As far as is known, only the one plant has been made in southern California and striped bass have never before been reported south of Monterey Bay. The fry at the time of planting were between two and three inches long, being fish of the year, spawned in April or May, 1916. If these fry had grown at the rate they do in San Francisco Bay they would have reached the size of five to eight inches in 1917, during their second year. If the fry reported by Mr. Pearson are some of the fry liberated in 1916 they are in their fourth year and their rate of growth has been remarkably slow. It is suggested that these five- to eight-inch fish are the progeny of the fish planted in 1916, but that can hardly be as a sufficient length of time has not elapsed, for it is pretty certain that striped bass do not spawn earlier than their fourth year and the fish planted in 1916 would not complete their fourth year until the spring of 1920. It would seem more probable that striped bass plants have been made of which we have no record or else striped bass which are plentiful in Monterey Bay have strayed to the south and occasionally spawn as far south as San Diego.

The striped bass is not native to the Pacific coast, but was introduced from the Atlantic coast in the early seventies and since that time has become quite plentiful.

KELP HARVESTING MAY BE RESUMED.

During the period of the war nearly four thousand tons of kelp were harvested each year in California waters. Upon the signing of the armistice practically all harvesting ceased as potash could not be extracted from the kelp economically enough to compete with the foreign potash which it was expected would be imported again in large quantities. In extracting potash from kelp many by-products were obtained which had never before been obtained in commercial quantities. As yet most of these by-products have not found a market. Much progress was made in developing more economical methods of obtaining the potash from kelp and it was hoped that if a market could be found for the by-products the kelp plants could continue to operate, but the armistice came sooner than expected and the plants closed down. Since then efforts have been made to place a duty on foreign potash, but as yet congress has taken no definite action. Efforts have also been made to find markets for the by-products and now one or more new companies which believe they have found the solution expect to resume the harvesting of kelp. The future of the industry will depend less on the value of the potash extracted than on the other chemicals which should be valuable when commercial uses for them can be found.

SARDINE RUN AT MONTEREY.

The sardine season at Monterey has been earlier than that usually considered normal. Canneries were running full capacity during July and August. During August the run was exceptionally large and the fish unusually firm and of good quality. This year there were more crews fishing sardines than ever before, forty-five crews operating, or an increase of seven crews over last year. The shortage of cans during the fruit season greatly curtailed the size of the sardine pack, which otherwise bid fair to break all records for this locality.

STEELHEAD.

It is often said by sportsmen that steelhead trout do not take the hook in open salt water. As contrary evidence a 3½-pound (cleaned weight) steelhead was caught July 23, 1919, on the hook in the open Monterey Bay and the local fishermen claim that such a catch is no great rarity. Several steelhead were also taken this year on the Mendocino County coast by the same method while fishing for salmon. During the summer of 1910 many steelhead were taken, during a period of six weeks, by trolling off Soquel in Monterey Bay. Many of the trout were caught a mile off shore.

SEAWEED AS FOOD.

The Chinese consider some of our seaweeds a very desirable basis for soups and several Monterey Chinamen make a business of catering to this demand. The weed is sun-dried and sacked, but held in the sack for further drying before shipment. During the last five months about 1,450 pounds, dry weight, have been shipped to such eastern points as Chicago, Cleveland, San Antonio and Newark.

SALMON AT MONTEREY.

The king salmon season just closed at Monterey resulted in one-half the normal season catch. The early run was not caught heavily because of a fishermen's strike and the late season run was light and ended early. The run of silver-side salmon was also light, but extended over a longer period than is usually credited to this fish. The silver salmon is said to suddenly appear in Monterey Bay, run heavily for a few days and suddenly disappear, but notes kept on the 1919 season show them as caught in small numbers between May 10 and July 26, with a heavy catch on four or five days during the period.

DRY SALTING FISH AT MONTEREY.

There are at present twelve firms engaged in the business of hard or dry salting fish at Monterey, representing an approximate investment of $50,000. One firm has invested $7,000 in equipment since last year. In addition, there are eight fresh-fish dealers who do considerable dry salting during otherwise slack periods. Several firms that operated last year have not yet opened up for business, September and October being the big months in the hard salting industry. The chief product is sardines in the form of salachini pressed into round 100, 65 and 50 pound tubs. Anchovies are usually put up in 5, 8 and 10 pound cans although some anchovy and sardine paste is made. Mackerel is salted in 200-pound barrels.

As yet the trade will not take any great quantity of these relatively new products on this coast, but the hard salt business promises to develop into a well established and increasingly large industry in the future.

SQUID AT MONTEREY.

This year for the first time in several years squid have been caught in quantity at Monterey. Three Chinese firms have dried this season about 1,772,000 pounds (fresh weight) of squid. Three tons of wet squid furnish one ton dried. Due to high labor cost this year the squid were not cleaned, merely dried on the ground, raked up and sacked. Fishermen were paid $10 per ton for the catch and the dried product sacked ready for shipment is valued at 6 to 7 cents per pound. Practically all this sacked product is shipped to China.

In addition, small quantities of squid have been canned in half pound rounds. The appreciation of fresh squid as a table delicacy is slowly growing, but people who delight in oysters and eels usually balk at squid tentacles till they have tried them once.

DO FISHERMEN GO FAR ENOUGH TO SEA TO GET THE FISH?

It is the belief of some of the canners of southern California that such pelagic fish as the tunas and albacores may be found in large numbers farther off shore than the fishermen usually fish. As the tuna canning industry has grown the fishermen have been getting larger boats and are fishing, during the latter part of the season, twenty to thirty miles off shore. Incoming ships have observed what they have taken to be schools of long finned tuna ("albacore") some two hundred miles off shore. To determine if

these fish are abundant at this distance off shore the Fish and Game Commission's launch "Albacore" was detailed to make an investigation and succeeded in finding albacore in abundance near San Nicholas or about eighty miles off the mainland. If these fish can be found in numbers at a greater distance off shore, larger fishing boats will be built and preparations made to fish farther at sea when tuna are not to be found closer to shore.

LARGE SALMON CATCH AT FORT BRAGG.

While the salmon catch this summer at Monterey was only half the usual amount the catch of salmon by trolling has been exceptionally large in the vicinity of Point Reyes in Marin County and near Fort Bragg and Shelter Cove on the northern California coast. The data has not yet been compiled, but it is believed the catch at Point Reyes as well as the catch near Fort Bragg has been double that of last year.

THE SACRAMENTO RUN OF SALMON.

After the opening of the season on the Sacramento River August 1, salmon ran in small numbers until August 28, when the fishermen began to get large catches in their gill nets and everything indicated that what is termed the "fall run" was on. The fish appeared to be larger than average and several very large individuals have been recorded. One was landed at the plant of the Western Fish Company at Pittsburg which exceeded seventy pounds in weight. No scales were taken from this salmon in order that its age might be determined, but judging from other large individuals whose age was determined from an examination of their scales it was not less than seven years old.

The appearance of the salmon being delivered at Pittsburg early in September would indicate that they would spawn early this year. They had more the appearance of fish which run three weeks later and it was argued by the fish dealers that the salmon run would end much sooner than usual.

Fig. 62. Looking down the Noyo River from the boat harbor at Noyo, California. This is the center of the salmon fishing industry of the north coast. Wonacotes photo.

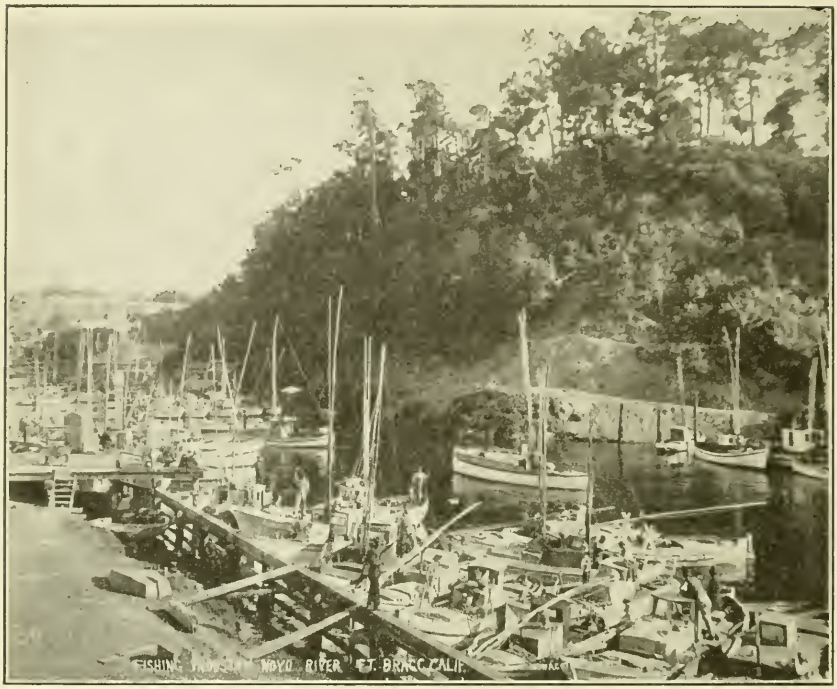

Fig. 63. Scene on Noyo River showing salmon fishing boats. Wonacotes photo.

NOTES FROM THE STATE FISHERIES LABORATORY.*

By Will F. Thompson and Elmer Higgins.

THE RECURRENCE OF THE FRIGATE MACKEREL.

In California Fish and Game for October, 1918 (Volume 4, Number 4, page 183), the first occurrence of the frigate mackerel, *Auxis thazard*, was noted. This was one of the remarkable features of the unusual summer season of 1918. At that time small catches were made in company with catches of skipjack (*Euthynnus*), yellow-fin tuna and some mackerel (*Scomber*). This year slightly larger individual boat catches were made of the frigate mackerel, but as the majority of the canneries refused them, they were not brought in as often. One catch of five tons was recorded by a single boat on the nineteenth of August. The first noted by the writer came in on the seventeenth of August, and the last on the twenty-second. Other catches at earlier and later dates were undoubtedly made, but the data have not yet been obtained from the statistical records. The average weight of these fish was 1.3 pounds before cleaning, and the loss of weight in cleaning and preparing for canning was very high. Therefore those canneries which accepted the species at the start of the run later refused to take any except for fertilizer.

It may be noted in connection with this species that mention of very young tuna or albacore may refer to the taking or observation of schools of the frigate mackerel. Fishermen unfamiliar with them, as was usually the case, were inclined to promptly refer them to the young of other species of the tuna group, frequently the blue-fin.—W. F. T.

*California State Fisheries Laboratory, Contribution No. 12.

THE SPAWNING OF THE GRUNION.

In Fish Bulletin No. 3, relating to the spawning of *Leuresthes tenuis*, the grunion, there is given on page 14 a chart showing the relation of the tides to the spawning times. As the paper was published on July 15, before the spawning season was over, no spawning periods were shown in July and August. However, since then, runs were observed on July 15, July 16 and August 14.

The runs on July 15 and 16 were small, but larger than that on August 14. The full moon occurred July 13 and August 11 (Greenwich mean civil time). Mr. Henry Shands, a field assistant for the laboratory, observed the run during July in the absence of the writer, and states that it was noticed by a considerable number of people, who remained on the beach to collect the fish. The run during August was observed by the writer, but so few fish were noticed that it seemed an accident to have taken them at all. Hence, although the fish were obtained on but one night, this fact does not mean that grunion did not run the usual three nights. No people were observed on the beach capturing the fish, this fact corroborating the observed small size of the run.

It will be noted, from the above-mentioned chart, that August 14 was the last date on which the grunion might be expected to run during the year 1919.—W. F. T.

CONTRIBUTIONS TO CANADIAN BIOLOGY.

Among additions to the library is a series of publications from the Canadian Biological Stations,* being studies made under the direction of the Biological Board of Canada, Professor E. E. Prince, Commissioner of Fisheries, Chairman. Included with them is a volume devoted to the Canadian Fisheries Expedition (Department of the Naval Service 1919), during which material was gathered for studies of the Canadian herring, the eggs and larvæ of the eastern coast of Canada, the hydrography of the region, etc., by Dr. Johan Hjort, and various associates. The publications are noteworthy, aside from the undoubted merit of the contributions, in that throughout many recent numbers there is an attempt to apply to American species the technique developed during the study of European fisheries by the International Council for the Study of the Sea.

The volume published under the direction of Dr. Johan Hjort includes in its covers two papers which are in good part general in character, dealing with the principles of the Norwegian work on the life history of the herring and of hydrographic work, the former by Einar Lea and the latter by J. W. Sandstrom. These papers will well repay the perusal both of the beginner and of the investigator, especially in the absence of general works dealing with the subjects.—W. F. T.

*Contributions to Canadian Biology, Supplements to the Annual Reports of the Department of Marine and Fisheries, Fisheries Branch, Ottawa, Canada.

BLUE-FIN AND YELLOW-FIN TUNA.

The catch of blue-fin tuna during 1919 was largely the work of purse seine boats, operating during the last part of the season in the northern waters around Santa Cruz Island. However, during the height of the run off Catalina Island, the schools invaded the prohibited waters of District 20. The statistics of the catch obtained during the subsequent weeks do not, therefore, give an accurate idea of the *abundance* of the fish because of the attempts of the seiners to evade the law, and the issuance of an injunction (August 13) against deputies seeking to enforce it. They are accurate, of course, in regard to the quantity taken.

A potential source of more serious error in statistics arose during the last part of August in the confusion by the weighers of yellow-fin with blue-fin tuna. The albacore boats began, about the twenty-fifth of August, to bring in numbers of large yellow-fin tuna (*Germo macropterus*), landing them at the canneries, in company with many smaller tuna. A close examination of these fish throughout the period of their run, which was not over on September 2, proved these fish to be usually of the one species, the "yellow-fin" tuna. It will be, in fact, a safe procedure to call nearly all tuna caught by albacore boats (other than combination net boats, which were not operating) during this period this species, in contradistinction to the blue-fin tuna

landed by the purse seine boats. But that even this leaves a certain error is undeniable, numbers of blue-fin tuna being brought in.

This is, incidentally, the first year in which these large yellow-fin tuna have been taken in this quantity in these waters. Last year the yellow-fin tuna taken were small, always under 30 pounds, while this year 75-pound fish (cleaned) were not rare, and one of them weighed 175 pounds cleaned, and was 65 inches in length. In fact, the blue-fin, or leaping, tuna did not exceed the size of these fish. It was not to be wondered at that these large, magnificent fish were at once called leaping tuna, traditionally the largest of our species.

However, the writer has satisfied himself by careful examination of a considerable series of fish that confusion need arise but very rarely between the species. Careful measurements have been taken of the body and fin proportions and compared according to standard methods used by ichthyologists in distinguishing species, but the more obvious characteristics may be reviewed here for the use of those who wish them, in view of the need for accuracy in statistics.

Color. The high fins above and below the fish (dorsal and anal fins) are usually tinged with yellow in the yellow-fin tuna, while they are as a rule dark in the blue-fin. The small finlets behind these are usually a brighter yellow in the yellow-fin.

The lower side of the body in both species bears characteristic markings, especially in the young. In the yellow-fin the marks tend to arrange themselves in alternate narrow transverse lines and rows of spots, and are smaller than those of the blue-fin, in which the spots are generally in transverse rows without intervening lines. In both species these spots become lengthened toward the tail. When freshly caught the yellow-fin, the young especially, has a strong lemon yellow tinge over most of the body, which is lacking in the blue-fin.

Pectoral fin. The length of the long side fin is the most obvious and reliable character by which the species can be distinguished, but very rarely a yellow-fin is found with a short fin. In the yellow-fin this side fin is almost always slightly shorter than the head, measured from the tip of the snout, and is not less than five-sixths of its length. In the blue-fin, this side fin is always less than two-thirds of the head length, and usually but three-fifths.

Head. The yellow-fin tuna has, as a rule, but not invariably, a shorter head than the blue-fin has.

Trunk of the body. The yellow-fin has a very noticeably shorter trunk than the blue-fin, if the "trunk" is considered the length before the two fins situated above and below the body. This holds only when fish of a size are compared and very large fish are likely to be hard to distinguish. The posterior part of the body where the finlets are is nevertheless more drawn out in the yellow-fin in comparison with the rest of the fish. Up to a certain length the fish seems to grow faster posteriorly, the young yellow-fin of 25 inches in length being similar in this characteristic to blue-fin of 45 inches.

Height of fins. The height of the two fins, one above and one below the body (dorsal and anal), differ markedly in the two species, but only when specimens of a size are compared. Yellow-fin tuna have higher fins (or longer, according to the way they are considered) but a yellow-fin of 30 inches in length has fins about as long in proportion as a blue-fin of 45 or 50 inches, although those of a 45-inch yellow-fin exceed the length of those of the blue-fin by a fourth of their length.

The eye. The eyes in the blue-fin tuna are actually nearly equal to those in yellow-fins of the same size, but because of the larger head in the blue-fin, they appear much smaller. The diameter of the eye in the blue-fin averages 3.2 per cent of the length of the body, and is about one-ninth of the head length, whereas that of the yellow-fin is 3.2 per cent of the body length, but about one eighth of the head length.—W. F. T.

THE OCCURRENCE OF THE LOUVAR.

On August 6, a large fish was brought into the canneries at Fish Harbor, San Pedro, from the west end of Catalina Island, and excited much comment as a probable hybrid between a pompano and a yellowtail. This proved far from the truth, however, the specimen in reality being a member of the "wide-ranging"

species *Luvarus imperialis* Rafinesque, once previously recorded from Catalina Island by Jordan & Starks in 1906 (as taken by Dr. C. F. Holder). It was an exceedingly active fish and very difficult to handle, although the small mouth and fine bristle-like teeth do not indicate predaceous habits.—W. F. T.

THE ABSENCE OF THE DOLPHIN FISH.

In 1918 the dolphin fish, *Coryphæna*, was frequently taken in local waters, and this fact was then often cited as evidence of a bad year for the fishing of albacore. However, this year the dolphin has not yet been in evidence (September 15), as far as we are able to determine, although the albacore season is far from normal. Indeed, the similarity between 1918 and 1919 is marked, the skipjacks (*Euthynnus*) having been running in quantity as they did last year, the frigate mackerel having appeared again, and the year being remarkable as before for the predominance of the tunas.—W. F. T.

TWO RARE FISHES.

To the lists of fish, new or rare in southern California waters, previously published may be added two species which came to the laboratory in June.

Four specimens of the pomfret, *Brama raii* (Bloch), were taken from a gill net near San Pedro by Mr. E. M. Nielson. The pomfret is an excellent food fish found in open seas, widely distributed, but taken only occasionally on our eastern or western coasts or in Europe.

Several specimens of *Cololabis saira* (Brevoort) were sent to us from San Diego by Mr. P. B. Clark, where they were taken along with a school of sardines in a round-haul net. The species is recorded from several localities on our California coast but is said to be very rare. This same species is occasionally found in large schools in Japan.—E. H.

THE "DAY" AND "NIGHT" SURF-FISHES OF NORTHERN CALIFORNIA.

Captain A. C. Tibbetts of Eureka, California, writes to the undersigned as follows:

" * * * state that the 'grunion' is the fish known here as the 'night surf-fish.' There is another known as the 'day surf-fish,' both varieties being caught in dip nets, in the same locality, viz, between Trinidad and Mad River. The Indians catch and dry these in large quantities. The 'day-fish' is larger than the 'night-fish,' has a yellowish tinge, the flesh is softer, and to my taste is inferior to the 'night-fish.' On the ninth instant (of August) I saw both kinds on sale at one of the Eureka markets. Small coasters running to the Klamath River bring occasionally to this place what is termed 'candle-fish.' These, even when salted and smoked, burn freely if a lighted match is applied to the tail. The Klamath River, as far as I know, is the only stream near here that furnishes this fish. All three of the above fishes have the appearance of smelt."

One of these species is *Thaleichthys pacificus*, the eulachon or candle fish; another is probably *Hypomesus pretiosus*, the surf-smelt, but we are not at all sure that the third is the grunion, *Leuresthes tenuis*. Both *Mallotus villosus*, the capelin, and *Leuresthes tenuis* are surf spawners and might possibly occur, and as the latter has not as yet been recorded north of Long Beach, considerable caution should be used in reaching a decision.—W. F. T.

THE OCCURRENCE OF THE ALBACORE NORTH OF SAN FRANCISCO.

Captain A. C. Tibbetts has also informed us that on September 22, 1884, he captured three albacore off the northern coast of California. His letter reads in part as follows:

"While in command of the schooner 'Volant,' I was coming from the westward, bound for Humboldt Bay, and instead of getting northerly winds as expected at this time of year, the wind came in fresh from the southward, increasing to a strong southeaster as we approached the coast, resulting in our closing with the land to northward as well as to leeward of our port. The wind after some hours moderated, and changed to light northwest. While running for Humboldt Bar, at four to five knots speed, somewhere between Redding Rock and Trinidad Head, I noticed fish working the same as they sometimes do on the coast of southern California, and out of curiosity threw a cod line with a white rag on the hook over the stern, and when the line straightened out got an albacore. Caught three, as fast as they could be unhooked and the line put out again. The fish appeared to be abundant, but those taken were dirtying things up around the after part of the deck, so fishing was stopped."

Captain Tibbetts is familiar with albacore, having taken them south of San Francisco. He believes the long southerly blow had reversed the usual coastal current and brought warmer water with it. Extracts from his log-book are given in his letter.

He also (October 17, 1883) records the occurrence of skipjacks (presumably *Euthynnus*) in considerable numbers 120 miles west of Trinidad, over what he thought to be a small uncharted area of shoal water, but in an area not now traveled to any extent.—W. F. T.

CONSERVATION IN OTHER STATES.

NEW YORK OPENS NEW HATCHERY.

The Conservation Commission of New York announces that the new fish hatchery at Dunkirk has been opened. This is the largest and most completely equipped of the twelve hatcheries maintained by New York and will be used largely for the propagation of the lake or greenback herring.

GAME REFUGES IN MINNESOTA.

Game refuges may be established without hearing in the state of Minnesota when all landowners concerned join in a petition. A public hearing is required otherwise. All state parks and state forest reserve lands are game refuges.

WASHINGTON FORMS STATE SPORTSMAN'S ASSOCIATION.

Washington sportsmen have formed an organization to further the interests of all the sportsmen of that state. The object is to assist in the propagation and protection of game animals, birds and fish, to influence legislation toward this end, and to promote such social conditions as are incident to the sport of hunting and angling. Its rapid progress voices itself in the slogan, "One thousand members in 1919."

QUEBEC ESTABLISHES BIRD REFUGES.

Great bird colonies situated on islands in the Gulf of St. Lawrence have been set aside as game refuges by the parliament of the province of Quebec. There are three definite areas in the county of Gaspe which are included. The first, known as Perce Rock, a breeding place for herring gulls and crested cormorants, Bonaventure Island with the largest surviving colony of the gannet, and the celebrated Bird Rock, the northernmost of the Magdalen Islands. Rigorous provisions of

Fig. 64. Deer captured while swimming in Lake Tahoe. Photograph by J. Sanders.

the law prohibit the molestation of the birds' nests or eggs, the carrying of a gun or other hunting gear within a mile of the refuges. Any boat used in violation of the law is liable to confiscation and heavy penalties of fine or imprisonment are provided.

PENNSYLVANIA PUNISHES VIOLATORS.

Severe sentences are becoming the rule. In the *Fishing Gazette* we read that Clyde Wilsoncroft and Roy Reynolds of Drury's Run, Pennsylvania, were arrested by the state police for illegal fishing. Each had sixty-five trout in his possession. The men were given a hearing before Squire Griffey, of Revono, and fined $650 each, or $10 for each trout caught. Not being able to pay the fine, both men must serve 650 days in the county jail.

LIFE HISTORY NOTES.

WEIGHTS OF MULE DEER.

Extravagant statements regarding the weights of mule deer are current. Most weights given are mere estimates. It is worth while, therefore, to record the weights of two bucks taken in the Granite Mountains, Washoe County, Nevada, about September 1, 1908. Careful weights taken on steelyards showed 217 pounds and 220 pounds after the entrails and feet had been removed. A dressed forked horn weighed 180 pounds.—F. P. CADY.

DEER CAPTURED IN LAKE TAHOE.

On January 26, 1919, Henry Sall, the caretaker of the Hellman resort on Lake Tahoe, discovered a deer swimming in Lake Tahoe about three-quarters of a mile out from land, and he immediately took after it in a boat. It was in an exhausted condition, and showed marks of having been attacked by a coyote or other animals. Mr. Sall took the deer home and took special care of it, and Mr. Hellman procured a permit from the Fish and Game Commission to keep it. After keeping the deer in captivity for a week carefully chained, it was given its freedom, and since then it has never strayed away from the property even though it has absolute freedom to roam over 43 acres of ground. It has adopted the house cat, seven setter dogs and one Airedale dog. The deer appeared to be about eight months old when captured. Its mate was found later by J. E. Pomin of Idlewild, near the Hellman property, partly devoured by coyotes.—JOSEPH H. SANDERS.

OREGON CÆSARIAN FAWN A MOST HEALTHY LITTLE ONE.

At Neskowin, Tillamook County, Oregon, during the summer of 1917 deer hounds were heard back in the mountains.

Fig. 65. Cæsarean fawn successfully reared in Oregon. Photograph by Raymond Walsh.

Soon they appeared on the beach, having driven out a doe. The weary doe made for the breakers and started for the rocks, then well covered with water. Later when the tide receded a search was made for the deer. She was found on the rock, but in an effort to reach safety her front

leg was broken. But, sadder yet, she was with fawn. Her life was taken and a Cæsarian was quickly undertaken by the rancher. The wee twin buck had been injured and was dead, but "Fawnie" was soon ready to eat. It was miles to any hygienic nipple and bottle, so one was improvised with a cork and straw. A bed and warmness was soon provided, but in a few days the little beggar preferred the hard floor—perhaps it was more like the sunny mountain side. Soon she was weaned and drank from the cup. Days and weeks passed, and what a pet! She was ever free to return to the mountains at any time, but she liked her foster mother too well. Later she was sent to the State Hospital Farm near Salem, where she is now well cared for.—Jane Fry Walsh.

UNITED STATES FOREST SERVICE CO-OPERATION.

RANGERS CO-OPERATE WITH GAME WARDENS.

Probably in no season since the Forest Service began its active campaigns of fire protection, road building, and the surveying of summer home sites and other projects which tend toward making the summer vacations of the mountain-loving people of California more attractive and

Fig. 66. Young mountain lion captured nea. Helena, Trinity County, California. Photograph by H. W. Brannan.

beneficial, has it been so handicapped by the lack of experienced men as it was during the summer of 1918. It was the war, of course. But in spite of the fact that it was not able to put on so many men as formerly during the summer, and in many cases one man was doing the work of two in ordinary years, no lack of interest was displayed in its co-operation with the Fish and Game Commission. A sincere interest in the protection and perpetuation of the game resources of the state is evident in all the reports from the Forest Supervisors, and in many instances it is the forest rangers who come forward with constructive suggestions for the improvement of game conditions. This is due partly to the fact that all Forest Service officials know that wild life is as much a natural resource as timber, and that it should be used wisely and under the proper regulations, and partly because they wish to assist the State Commission through its local representatives who are in many localities a part almost of the Forest Service organization, good fellowship and mutual help being the rule between rangers and game wardens.

DEER IN THE NATIONAL FORESTS.

In looking over the reports we find that 2,943 deer were killed in the National Forests last season. This is an accurate record and is only what is actually known of the kill. In many cases the Forest Supervisors say that this does not represent the actual kill, which might readily be estimated at 10 or 15 per cent higher. In most localities they are holding their own and in some a decrease has been noticed. The chief factors which affect and have a direct bearing on the number are the extension of the road system under the spur of the autoist, and the increasing number of people who spend part of their vacation in the mountains. The most serious factor is the apparent increase in the coyotes and mountain lions. The campaign conducted by counties, the Biological Survey and the state has not yet (from the reports) been

intensive enough to rid the mountains of these pests to any appreciable degree. Unless it is carried on more forcefully we are liable to see a steady, if not rapid, decrease in the deer. Where sheep are grazed in the mountains during the summer months the coyotes seem to prefer them as a more easy prey than the deer, attacking the latter only in the winter. But where few sheep are grazed the reports are emphatic in the assertion that coyotes do more damage than the hunters. In parts of the Klamath Forest it is impossible to raise sheep or goats unless kept within a fence, and in other sheep raising countries the coyotes take a serious toll every year.

The mountain lion is even a more implacable foe of the deer than the coyote, and if it should become as widespread in its range and habitat it would mean the sure and early doom of the deer. Fortunately, at present, the Klamath, Trinity, Shasta, California, and Santa Barbara Forests are the only ones that report serious trouble, although the El Dorado, Stanislaus and Sierra report an increase in the numbers of lion in the last year. Here the trouble is traced to the Yosemite National Park, which has been a breeding ground for them, as no hunting or trapping is allowed except by Park Rangers or government hunters. Higher bounties and more vigorous prosecution of the work of extermination of both the lion and the more prevalent and destructive coyote are vigorously recommended.

OWENS VALLEY RESIDENTS ALL GO FISHING.

A fishing day for the Owens River Valley, when almost the entire population closes stores and homes and goes out to catch the first trout of the season, has, according to Supervisor Jordan, become an established institution.

STRANGE DEER KILLED.

Ranger Harley of the Klamath Forest reports the killing of a pure white deer and a pure black one, and adds that he has seen a third and greater wonder in the deer line, one with white head, neck, legs and belly, and cream colored sides and back.

REPORTS.

SEIZURES—FISH, GAME AND ILLEGALLY USED FISHING APPARATUS.

March 1, 1919, to June 30, 1919.

Game.

Deer meat	345 pounds
Ducks	32
Doves	3
Quail	12
Deer heads	2
Aigrettes	59

Fish.

Smelt	8 pounds
Halibut	3,650 pounds
Trout	78 pounds
Barracuda	1,591 pounds
Striped bass	1,971 pounds
Black bass	9 pounds
Catfish	178 pounds
Salmon	475 pounds
Yellow fin croaker	23,600 pounds
Crabs	1,031
Pismo clams	1,933
Abalones	383 pounds
Abalones (dried)	1,157 pounds
Lobsters	8
Dried shrimps	1,200 pounds
Set lines	3
Illegal nets	3

Searches.

Illegal fish and game	23

CALIFORNIA FRESH FISHERY PRODUCTS. COMPILED BY DEPARTMENT OF COMMERCIAL FISHERIES—APRIL, MAY, JUNE, 1919.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Tehama, Glenn, Colusa	Contra Costa, Alameda	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego	Total	Mexico
Albacore												375,221		277,745	652,966	17
Anchovy			146,100					490		76,040		249,062			471,692	
Barracuda												1,749,273	37,840	535,436	2,322,549	22,719
Blue fish									13	11,773					11,786	
Bocaccio								6,168	70	161,575					167,813	
Bonito											23	34,679	274	29,935	64,911	375
Carp		3,455		1,661	42,468		10,013	13,252							70,852	
Catfish		9,725		6,351	46,503		24,359								86,938	
Chilipepper								125,827		931					126,758	
Coalfish								23,520		715					24,235	
Cultus cod	254	8,263						320,028	6,304	8,826		1,791			345,402	
Dogfish							273	20,405		3,152	475	8,390		56,344	89,039	
Eel								10							10	
Flounder	1,050		730	1,335			269	152,988	4,785	439	525	1,479	61		163,031	
Greenfish												2,405			2,405	
Hake								37,575	6,853	710		959		2,870	48,969	
Halibut	4,948	24,772	465					8,342	854	3,726	116,506	522,809	33,419	180,160	896,001	101,485
Hard head					5,397										5,397	
Herring	150		16,670				1,470	3,710							22,000	
Kingfish								14,351	12,614	36,813	193	37,766	21	674	102,432	
Mackerel									7	16,016	2,799	761,737	2,473	18,230	801,262	2,115
Marlin																
Mullet												270			270	
Perch	8,442		31,559				47	1,384	5,923	228		569		860	49,022	1,140
Pike				8	752		141								901	
Pompano								67	571	41		2,019		199	2,897	
Rock bass											58	57,156	890	94,760	152,774	120
Rockfish	3,718	993						99,283	21,518	50,639	36,029	103,529	61	102,757	419,457	20,315
Salmon	17,752	409,172	12,252	315,359	90,984	148,614	468,832	60,756	482,556	2,014,266					4,020,543	
Sand dab								315,958	15,189	1,100	583	2,258			334,689	
Sardine								4,825	95,525	2,079,720		22,067,551		4,260,642	28,639,596	
Sculpin												5,427			5,427	
Sea bass (black)											295	4,786	175	9,573	14,823	2,982
Sea bass (white)			171						2,953	96	3,275	720,033	295	27,051	753,877	2,510
Sea trout												5,193		2,001	7,194	
Shad				40,179	83,730		3,717	8,585				25			136,036	
Shad (buck)				143,815	14,050		270,875								428,740	
Shad (roe)				175,939	16,671		737,931								930,541	

Sheepshead												456		200	656	
Skate								92,832				315			93,147	
Skipjack												9		104	113	10,665
Smelt	14,081		20,132					29,916	12,784	11,783	613	26,608	375	2,752	119,024	
Sole		15						1,167,333	174,682	25,569	11,980	18,399		222	1,398,260	
Splittail					187										187	
Striped bass			771	92,935	53,700		102,726	49,077							299,209	
Stingaree																
Suckers					360		43								403	
Surf fish																
Sword fish																
Tom cod								13,021							13,021	
Trout (farm)																
Trout (steelhead)																
Tuna														33,165	33,165	164,511
Tuna (blue fin)																
Tuna (yellow fin)												1,659,119			1,659,119	
Turbot			1,030					183				331,729			332,942	
White bait			36					2,792							2,828	
Yellowtail											191	421,663	26	381,014	802,894	4,580
Miscellaneous					599			5,001	28	1,328	18,945	151,128	162	2,804	179,995	3,903
Total fish	50,395	456,398	229,916	777,585	355,401	148,614	1,620,696	2,577,480	843,224	4,636,851	192,990	29,323,807	75,982	6,019,498	47,308,837	337,437
Crustaceans—																
Crabs (doz.)								20,996	120	8					21,124	
Ecrevisse (doz.)																
Shrimp								256,232							256,232	
Spiny lobster																
Mollusks—																
Abalones	450									33,550	151,738				185,738	
Clams (cockle)			9,040									211			9,251	
Clams (mixed)	6,860		13,261					80				55			20,256	
Clams (pismo)											138,553				138,553	
Clams (soft shell)		3,565	11,631				73,387								88,583	
Cuttlefish								1,399	142	809	107	3,812			6,269	
Mussels	140						1,600				2,779	2,432			6,951	
*Oyster (shell) No.			252,450												252,450	
†Oyster, lbs.			22,985												22,985	
Snails																
Squid									92	3,612,357		6,622			3,619,071	
Miscellaneous—																
Frogs (doz.)								305							305	
Terrapin (doz.)	2	2						63							67	
Turtle																2,239

*Eastern. †Native.

VIOLATIONS OF FISH AND GAME LAWS.

March 1, 1919, to June 30, 1919.

Offense	Number of arrests	Fines imposed
Game.		
Hunting without a license	7	$155 00
Deer—close season—killing or possession	22	460 00
Female deer, spike bucks, fawns—killing or possession	2	50 00
Running deer with dogs—close season	1	25 00
Illegal deer hides	1	25 00
Refusing to show license on demand	3	35 00
Selling an eagle	1	5 00
Nongame birds—killing or possession	5	55 00
Cottontail and brush rabbits—close season—killing or possession	3	75 00
Wild pheasant—close season—killing or possession	1	100 00
Tree squirrel—close season—killing or possession	1	----------
Goose and mudhens—close season—killing or possession	1	25 00
Ducks—close season—killing or possession	1	50 00
Golden eagle in possession	1	25 00
Doves—close season—killing or possession	3	50 00
Quail—close season—killing or possession	3	75 00
Black sea brant—close season—killing or possession	1	----------
Total game violations	57	$1,210 00
Fish.		
Angling without license	16	$430 00
Fishing for profit without a license	19	160 00
Refusing to show license on demand	1	25 00
Clams—undersize—close season—taking or possession	9	250 00
Crabs—undersize—close season—taking or possession	10	80 00
Using a set line	2	----------
Offering trout for shipment by parcel post	2	50 00
Trout—close season—excess limit—taking or possession	17	410 00
Trout—taking other than by hook and line	2	50 00
Catfish—undersize—offering for sale	3	60 00
Salt water eels—undersize—taking or possession	2	120 00
Using a fish trap	1	100 00
Dried shrimps—possession	2	----------
Abalones—close season—undersize—taking or possession	26	550 00
Spring lobsters—close season—undersize—taking or possession	4	80 00
Sturgeon—close season—undersize—taking or possession	2	40 00
Black bass—close season—undersize—taking or possession	1	20 00
Black bass—taking other than by hook and line	1	50 00
Striped bass—undersize—excess limit—taking or possession	----------	----------
Perch—buying or selling—close season	2	30 00
Selling young fish for bait	1	20 00
Taking salmon with snag hook	1	100 00
Buying and selling salmon taken in District No. 1—close season—excess limit	3	300 00
Using a net less than ½-inch mesh for bass	1	20 00
Pollution of waters	1	----------
Total fish violations	132	$2,985 00
Grand total fish and game violations	189	$4,195 00

STATEMENT OF EXPENDITURES—YEAR 1919.

Items of expense	January	February	March	April	May
General administration	$1,770 04	$2,079 71	$1,903 79	$2,220 16	$2,172 26
Research, publicity and educational (game)	280 68	242 33	349 62	368 16	259 82
Printing	841 07	722 18	78 89	102 51	628 86
Fish exhibits					
Game exhibits					
Tahoe camping ground					
Mountain lion bounties	1,140 00	680 00	980 00	890 09	470 00
Lithographing hunting licenses					
Lithographing angling licenses					
Hunting license commissions	1,675 00	631 90	1,533 90	1,162 70	1,006 50
Angling license commissions	1,090 10	215 70	894 20	1,234 90	623 10
Market fishing license commissions	10 00	25 90	230 50	149 50	103 00
Hunting lions					
	$6,807 09	$4,596 72	$5,970 90	$6,127 87	$5,263 54
San Francisco district	$6,115 72	$6,009 58	$5,851 79	$6,383 82	$6,491 09
Sacramento District	3,936 85	3,825 74	4,225 44	4,235 63	4,662 93
Los Angeles District	2,504 87	2,627 60	2,379 75	2,524 90	2,397 03
Launch patrol	1,048 47	1,112 90	1,008 73	1,059 40	6,233 47
Prosecutions (fish and game)	129 45	64 00	86 60	67 25	260 00
Crawfish inspections	200 00	200 00	300 00	100 00	58 06
Winter game feeding					
Accident and death claims	124 04	161 10	124 04	155 05	124 04
	$14,059 40	$14,000 92	$13,976 35	$14,526 05	$20,226 62
Hatchery administration	$987 20	$980 29	$977 96	$1,168 05	$1,245 86
Mount Shasta hatchery	2,097 03	1,403 00	1,704 90	2,527 52	4,425 23
Klamath station	487 82	111 00	5 00	56 60	5 00
Fall Creek hatchery	448 12	792 86	1,020 13	1,039 91	798 70
Mount Whitney hatchery	1,070 01	2,046 22	1,184 98	1,572 61	1,676 33
Cottonwood Creek station		163 75	161 65	217 67	82 81
Cottonwood Lakes station				22 12	2 55
Tahoe hatchery	6 00	5 00		5 00	5 00
Tallac hatchery	5 00	5 00	354 07	501 50	1,276 49
Chico experimental station					

Item of expense	January	February	[illegible]	April	May
Fort Seward hatchery	368 50	322 41	279 50	348 47	336 07
Eel River station	28 77				
Ukiah hatchery	1 50			214 90	547 32
Snow Mountain station	91 83	377 05	427 10	382 14	241 00
Brookdale hatchery	391 44	488 46	278 22	236 15	283 91
Scott Creek station	61 00	92 47	70 00	140 70	69 05
Feather River hatchery		1 20			
Almanor hatchery	12 44	367 40	154 00	172 50	186 52
Domingo Springs hatchery			202 25	191 75	238 72
Clear Creek hatchery					57 75
Bear Lake Hatchery				200 00	
North Creek station	1 03	19 75	386 86	723 17	990 51
Wawona hatchery					178 45
Yosemite hatchery			15 48	371 58	194 22
Kaweah hatchery				148 10	129 58
Fish transplanting	3 00	3 00	3 00	3 00	3 00
Screens, fishways and water pollution	456 36	545 09	649 30	712 69	809 78
Special field investigation					
	$6,517 05	$7,723 95	$7,874 40	$10,954 93	$13,783 85
Department of Commercial Fisheries	2,449 80	2,647 27	2,836 84	2,796 35	3,377 57
	$29,833 34	$28,968 86	$30,658 49	$31,405 20	$42,651 58

INDEX TO VOLUME 5.

A

Abalone, 45, 68, 95, 96, 101, 162, 164, 167, 182, 209.
Accident, 30.
Accusation, and defense, 176–185.
Agriculture, wild life in relation to, 99.
Airplane, to locate fish, 148.
Albacore, 24, 30, 39, 41, 44, 58, 80, 94, 95, 96, 109, 145, 147, 155, 162, 163, 164, 166, 182, 198, 200, 203, 208; occurrence north of San Francisco, 203.
"Albacore," launch, 95, 182, 199; attempts to aid fishermen, 94.
Albula vulpes, 158.
Alga, 70.
Allen, B. M., 70, 182.
Alosa sapidissima, 158.
Amadou, 170.
Ameiurus nebulosus, 22.
AMERICAN FIELD, 84.
Anadromous, 105, 112.
Anchovy, 44, 109, 162, 163, 164, 166, 198, 208.
Angler, 17, 38, 43, 75, 77, 80, 110, 112, 113, 114, 115, 117, 128, 139, 178, 179, 180; versus net fishermen, 187–188; attention!, 192.
  Dry-fly, 109, 110, 137, 140.
Angleworm, 139, 140; eaten by mole, 99.
Angling, 42, 77, 192, 204.
Animal, 34, 95, 97, 98, 157, 158.
  Carnivorous, 143.
  Fur-bearing, 81, 83, 84.
  Game, 79, 204.
  Predatory, 81, 83, 161, 179.
Anisotremus davidsoni, 60, 65, 66.
Anoplopoma fimbria, 158.
Antelope, Prong-horned, 181.
Antler, 161.
Aquarium, 70, 82, 97.
Auxis thazard, 200.

B

Babcock, J. P., 90, 178.
Badger, 149.
Bag limit, 31, 190.
Bait, 110, 119, 122, 139, 141, 171.
Balaenoptera borealis, 80.
Baleen, 89.
Barbel, 1, 20, 156.
Barnhart, P. S., notes on the artificial propagation of the spiny lobster, 70–71.
Barracuda, 44, 100, 145, 146, 154, 155, 162, 163, 164, 166, 208.
Bass, 44, 60, 63, 64, 177; and bass-like fishes of California, 59–68.
  Black, 179, 193; is not true bass, 149.
  Big-eyed, 60, 66.
  Calico, 179.
  Kelp, 60, 63, 64, 65.
    Spotted, 60, 64, 65.
  Rock, 44, 60, 63, 64, 100, 164, 166, 208.
  Sand, 60, 63.
  Sea, 13, 163.
    Black, 44, 60, 62, 80, 100, 163, 164, 166, 208.
    Giant, 60, 80.
    White, 14, 15, 16, 20, 44, 100, 164, 166, 208.
  Striped, 3, 10, 11, 12, 44, 61, 62, 94, 101, 145, 164, 166, 179, 183, 193, 209; taken in Mission Bay, 197.
Bear, 149; hunting with bows and arrows, 69–70.
  Black, 69, 70, 78, 79.
  Grizzly, 172.
Beaver, 181; hides confiscated, 79.
Biennial, 1916–1918, 30.
Biology, contributions to Canadian, 201.
Biological Station, want protection, 93–94.
Bird, 32, 77, 79, 82, 83, 84, 88, 89, 99, 192; how do they find their way?, 83–84; wild, and legislation, 87–88; fly larvæ suck blood of nestling birds, 88; study, 86.
  Game, 79, 81, 85, 87, 89, 90, 97, 182, 204; of California, 84–86, 181; English, vindicated, 86–87.
  Insectivorous, 80, 83.
  Migratory, 36, 80, 83, 192; *see* Migratory Bird Treaty Act.
  Nongame, 79.
  Predatory, 81.
Blackbird, 182; and rice, 99.
Blacksmith, 43.
Blind, 191.
Bluefish, 17, 44, 100, 164, 166, 208.
  California, 14, 16.
Boat, 5; northern join fishing fleet, 155.
  Purse-seine, 155, 156.
Bobcat, 69.
Bocaccio, 44, 100, 164, 166, 208.
Bonito, 44, 100, 145, 146, 162, 163, 164, 208.
Boothe, Roy, state game district 1K, 81–82.
Bosqui, E. L., 178; valley quail with egg in December, 98.
Botfly, 142.
Boucher, E. C., the angler versus the net fisherman, 187–188.
Bounty, 27, 29, 76, 148, 180, 207.
Bow and arrow in hunting, 69–70.
Boyle, Una, 79; river otter plays on moonlight nights, 98.
Brama raii, 203.
Bream, Golden, 22.
Brooks, Major Allan, 85.
Bruce, J. C., 91, 150, 195; a death struggle between bucks, 160–161.
Bryant, H. C., 84, 181, 189.; wild birds and legislation, 87; California trout, 105–135.
Buck, 26, 81, 82, 161, 190, 206; death struggle between, 160–161.

Bureau of Education, Publicity and Research, 77.
Burrill, A. C., is the herring gull insectivorous?, 71–74.

C

Cabrilla, 60, 64, 65.
Cady, F. P., weights of mule deer, 205.
California Academy of Sciences, 83.
CALIFORNIA FISH AND GAME, 94, 96, 145, 154, 156, 158, 178, 180, 182, 194, 195.
California Museum of Vertebrate Zoology, 85, 142.
California Nature Study League, 145, 189.
California-Oregon Power Company, 91, 93, 184.
California State Fisheries Laboratory, 56.
Camp, 3; Lake Tahoe Public, 189, 190.
Canary, 82.
Cancer magister, 158, 182.
Candlefish, 203.
Cannery, 40, 148, 197, 200, 202; established at Ensenada, 94; receives Mexican fish, 158; floating, burns, 156.
Canvasback, 191.
Capelin, 203.
Caraux hippos, 158.
Carp, 44, 100, 164, 166, 208.
Carpenter, S. J., 78, 79.
Carriel, 93.
Cast, 109, 114, 141, 170.
Cat, 43, 83; becomes game in New York, 42; manicure the bird-catching cat, 82–83.
Catfish, 44, 100, 164, 166, 179, 193, 208.
Catron, E. S., 78.
Census, *see* Game.
Chambers, Frank, 78.
Charr, 105, 106, 107, 129, 130, 134.
Chilipepper, 44, 100, 164, 166, 208.
Chromis punctipennis, 43.
Citharichthys stigmæus, 157.
xanthostigma, 95.
Clam, 35, 68, 147, 158; investigation, 158.
Cockle, 45, 101, 164, 167, 209.
Pismo, 45, 101, 164, 167, 209; destroyed by oil, 174–175.
Razor, 175.
Soft-shelled, 45, 101, 164, 167, 209.
Clark, F. C., 182.
Coalfish, 44, 100, 164, 166, 208.
Cobb, J. N., college of fisheries established, 147–148.
Cod, 35, 147, 157, 203.
Black, taken near San Pedro, 158.
Cultus, 44, 100, 164, 166, 208.
Rock, 154, 163.
Coccidiosis, 143.
Coccidium oviforme, 143.
Cochinito, 159.
Cocnurus serialis, 143.
Collinge, W. E., 86, 87.
Cololabis saira, 203.
Columba fasciata, 160.
Commercial Fishery, *see* under Fishery.
Connell, M. J., 180.
Conservation, 30, 76, 77, 178, 179, 180, 189, 192; lessons from Massachusetts, 42; of our fisheries, 49–59; of fish, 80–81; in other states, 42, 97, 159, 204; persuasion versus compulsion in fish and game, 187; deer in New York, 190.
Commission, 84.
Louisiana, 90.
New York, 82, 97, 204.
Conservationist, 80, 177; a suggestion for California, 84.
Corvina, 13, 17.
Corvus nilotieus, 94.
Coryphana, 203.
Cottontail, *see* Rabbit.
Coyote, 149, 150, 161, 205, 207; as a deer killer, 26–29.
Crab, 10, 45, 101, 146, 147, 164, 167, 171, 179, 182, 209.
Sand, 175; habits and uses of the, 171–172.
Crago franciscorum, 9.
nigricauda, 9.
Crampton, J. M., 86.
Crandall, W. C., 183.
Crane, 85.
Crappie, 179, 193.
Crawfish, 94, 146, 182.
Cristovomer, 107, 133.
namaycush, 109, 111, 134.
Croaker, 41, 59, 100, 164; fish of, family, 13–20.
Black, 14, 19.
Chinese, 14, 19.
Spotfin, 14, 18.
White, 14, 15.
Yellowfin, 14, 17.
Crustacean, 10, 45, 87, 101, 133, 164, 167, 171, 209.
Cunningham, F. P., grouse in the Sequoia National Forest, 98.
Curlew, 85.
Curtner, W. W., 182.
Cutcrebra, 142.
Cuttlefish, 45, 101, 164, 167, 209.
Cynoscion nobilis, 13, 14, 15, 16.
parvipinnus, 13, 14, 16.

D

Dabelstein, W. F., 193.
Dafila acuta, 43.
Dall, W. H., 82.
Darter, 60.
Deer, 30, 34, 69, 97, 148, 149, 172, 182, 186, 205, 207; killed by coyote, 26–29; increasing in Trinity County, 98; hunting poor in Mono County, 98; conservation in New York, 189; in the national forests, 206–207; strange deer killed, 207; captured in Lake Tahoe, 205.
Mule, weights of, 205.
De Laveaga, J. V., tree-ducks successfully bred in Santa Clara County, 42–43.
Dendrocygna bicolor, 42, 43.

De Ong, E. R., parasites which affect the food value of rabbits, 142–143.
Depredation, 179.
Deputy, 91; acquitted at trial, 79.
Dip-net, 90.
Dirks, W. N., mole eats angleworms, 99.
Discretionary powers, Fish and Game Commission needs, 30.
Disease, 182; again appears, 32.
  Duck, 36.
  Quail, 88.
Dixon, J., 142.
Doe, 28, 81, 206.
Dog, 69.
  Varmint, 91.
Dogfish, 44, 100, 164, 166, 208.
Dolly Varden, *see* Trout..
Dolphin, 44, 100, 164; absence of, 203.
Dove, 85, 179.
Downing, Earle, banded pintail taken in Alameda County, 43.
Duck, 32, 43, 76, 78, 80, 85, 97, 99, 173, 179, 180, 182, 191, 192, 195; Louisiana originates, 34; versus rice, 36, 182; destroy garden pests, 99; food of, 87.
  Black, 34.
  Canvasback, 191.
  Mallard, 34, 191.
  Pintail, 191; banded taken in Alameda County, 43.
Duke, R. D., 79, 178.

E

Eagle, 138.
Earthworm, 99.
Ecrevisse, 45, 101, 164, 167, 209.
Eden, Mr., resolution by, 176–179.
EDITORIALS.
  The 1916–18 biennial, 30; Fish and Game Commission needs plenary powers, 30; California laws will be modified to agree with federal game laws, 31; violators make queer defense, 31; Monterey streams stocked, 31; duck disease again appears, 32; federal permits, 32; fish cookery demonstrations, 32; increased consumption of fish necessary, 33; notes on the game refuges, 33; a new game farming project, 34; Louisiana originates new duck, 34; Alaska fishery products, 34; Nova Scotia uses war methods to capture violators, 35; California trappers and their catch, 35; our mailing list, 70; pending legislation, 70; Fish and Game Commission inaugurates educational work in summer resorts, 70; preserve game resources, 77; large profits with slight outlay, 77; "now begins the season," 78; conviction made under federal migratory bird treaty act, 78; Mendocino rancher makes good kill, 78; game laws to be enforced in national forests, 79; beaver hides confiscated, 79; deputy acquitted at trial, 79; wartime saving in cost of fish food, 79; the Pacific coast whale industry, 80; food administration regulations on fishing no longer effective, 80; more bird treaties needed, 80; conservation of fish, 80; dependable information is needed, 81; state game district 1K, 81; is the porcupine worth saving?, 82; manicure the bird-catching cat, 82; a plan to conserve Wyoming elk, 83; fur farming in Alaska, 83; how do birds find their way?, 83; a suggestion for California conservationists, 84; the game birds of California, 84; passenger pigeons reported in eastern states, 86; English game birds vindicated, 86; the ground squirrels of California, 87; the food of mallard ducks, 87; wild birds and legislation, 87; fly larvæ suck blood of nestling birds, 88; importation of quail from Mexico, 88; federal migratory bird law, 89; long run of a tagged salmon, 90; night herons game in Louisiana, 90; vindication, 145; nature study libraries to be furnished summer resorts, 145; the 1918 catch of fish, 145; maintain a supply, 146; rainbow trout acclimatized in Argentina, 146; a college of fisheries established, 147; trout fry distributed in lakes and streams of California during past three years, 147; many lions killed, 148; airplanes to locate fish, 148; fishery products laboratory established, 149; the ownership of wild life, 149; our fur resources, 149; black bass is not a true bass, 149; persuasion versus compulsion in fish and game conservation, 187; the angler versus the net fisherman, 187–188; educational work in summer resorts, 189; Tahoe public camp, 189–190; deer conservation in New York, 190; migratory bird treaty act constitutional, 190–191; waterfowl die from eating shot, 191; government needs deputy chief game warden, 191–192; anglers, attention!, 192; additional migratory bird treaties needed, 192; State Fair exhibit, 193; game censuses, 193–194; hatchery department moves, 194; colored prints of golden trout available, 194.
Educational work inaugurated at summer resorts, 76–77, 189.
Eel, 198, 208.
Egg, Bird, 79, 85, 98, 204.
  Falcon, 87.
  Fish, 76, 96, 132.
  Fulvous tree duck, 42.
  Goshawk, 87.
  Grunion, 156.
  Pigeon, band-tailed, 160.
  Salmon, 41, 92, 110, 115, 141, 151.
  Shrimp, 9.
  Spiny lobster, 24.
  Trout, 37, 38, 39, 92, 115, 127, 131, 133, 151, 152, 153, 176, 181.
Egret, 80.
Eigenmann, C. H., 135.
Elk, 97; plan to conserve Wyoming, 83; Washington will open season on, 97; in Shasta County, 98.

Emerita, 175.
analoga, 171.
Emerson, Ethel, 43.
Epidemic, 36.
Eulachon, 203.
Euthynnus, 200, 203, 204
Evermann, B. W., 115, 119, 135, 138; California trout, 105–135.
Exonautes rondeletii, 95.

F

Facts of current interest, 36, 91, 150, 195.
Falcon, 87.
Farm, Game, 87.
Fat herring, 52.
Fawn, 190; cæsarian healthy, 205.
Feline, 82.
Fertilizer, 10, 91, 148, 154, 163, 209.
Finch, California Purple, 88.
Fish, 2, 31, 41, 50, 53, 56, 57, 59, 62, 68, 72, 76, 77, 78, 79, 80, 82, 87, 90, 91, 94, 95, 97, 105, 115, 133, 135, 146, 147, 149, 150, 156, 172, 176, 177, 178, 179, 180, 185, 195, 197, 201, 204; of croaker family, 13–20; cookery demonstrations, 32; distributed in Minnesota, 42; rare from Monterey Bay, 43; conservation of, 80; proposed change of shrimp law would menace life of fish, 94; 1918 catch of, 145; airplanes to locate, 148; better records necessary, 154–155; fresh, used by reduction plants, 154; flat of California, 182; do fishermen go far enough to get, 198–199; dry salting at Monterey, 198; goat fish taken in California, 156; two rare, 203.
Culture, 147, 148, 152.
Culturist, 106.
Dealer, 199.
Food, 13, 16, 20, 62, 63, 64, 80, 112, 135, 156, 161, 179.
Game, 62, 112, 135, 177.
Ladder, *see* Fishway.
Screen, *see* Screen.
Fish and Game Commission, California, 2, 24, 30, 36, 39, 40, 70, 75, 76, 84, 91, 93, 94, 96, 119, 131, 153, 176, 178, 179, 180, 181, 182, 183, 185, 188, 189, 197, 199, 205; inaugurates educational work at summer resorts, 76–77.
Connecticut, 86.
Massachusetts, 42.
Minnesota, 42, 152.
New Jersey, 42.
Vermont, 81; plans quarterly bulletin, 97.
Washington, maintains permanent exhibit, 97.
Fish and Game District 1A, 33; 1B, 33; 1C, 33; 1I, 33; 1J, 33; 1L, 33; 2A, 33; 4A, 33; 4B, 33; 1K, 81–82; 2, 179; 4, 179; 20, 188.
Fisher, C. O., 26.
Fisherman, 13, 16, 40, 41, 42, 43, 58, 59, 73, 79, 95, 106, 109, 110, 128, 147, 154, 157, 159, 172, 180, 196, 198, 200; do fishermen go far enough to sea?, 198–199; launch "Albacore" attempts to aid, 94; receive 20 cents for first tuna, 156.
Commercial, 148, 178.
Dry-fly, 170.
Fly, 116, 141.
Fishery, 30, 34, 182; Alaska products, 34–35; commercial notes, 93–94; conservation of, 49–50; department of, 146, 155, 182, 195; products laboratory established, 149; reforms in Nova Scotia service, 159–160.
Commercial, 80, 147.
Halibut, 34, 50.
Herring, 35.
Laboratory, California State, 171, 174, 195.
Sardine, 51.
Shrimp, 34, 50, 183.
Fishing, 147, 148, 171, 192, 204; Owens Valley residents go, 207.
Some notes on dry-fly, 169–170.
Fishway, 39, 40, 76, 93, 97, 177, 178, 184.
Flatfish, 96; life history of, 157.
Flounder, 2, 10, 33, 44, 100, 164, 166, 208.
Big-mouthed, 157.
Diamond, 157.
Long-finned, 157.
Sharp-ridged, 157.
Soft, 21.
Fly, 109, 110, 112, 113, 126, 127, 130, 133, 137, 139, 140, 141; larvæ suck blood of nestling birds, 88.
Dobson, 139.
Dragon, 22.
Dry, 169.
Fisherman, 141.
Flying fish, 81.
Fontinalis, 130.
Food, 86, 112, 135; of fish, 80; of grouse, 98; of mallard ducks, 87; of porpoise, 157; of trout, 133; wartime saving in cost of fish food, 79–80; of birds, 181; of ducks, 181.
Friend, Wm., 26.
Frog, 209.
Fry, 197.
Trout, 30, 92, 93, 152.
Rainbow, 152.
Fuertes, L. A., 85.
Fur, 35; farming in Alaska, 83; our resources, 149.
Bearer, 35, 81, 83, 84, 150, 181.

G

Game, 27, 31, 62, 76, 77, 78, 81, 84, 97, 112, 114, 119, 126, 130, 135, 146, 149, 150, 176, 177, 178, 180, 181, 192, 194; parcel post shipments of, 30; birds of California, 84–86; conditions in southern California thirty-five years ago, 172–173.
Census, 81, 193, 194.
Farm, 34, 36, 42, 87, 177, 184; new project, 34.
Law, *see* Law.
Preserve, *see* Preserve.
Refuge, *see* Refuge.
Gannet, 204.
Gasterosteus, 21.
aculeatus, 23.
Gear, 6, 95.
Genyonemus, 13.
lineatus, 14, 15, 20.

George, Thomas, 124.
Germo macropteris, 201.
Gilbert, Dr. C. H., 96, 137, 182, 185.
Girella nigricans, 60, 67.
Goat fish, taken in California, 156.
Godwit, Marbled, 191.
Goldfinch, Green-backed, 88.
Willow, 88.
Goose, 31, 37, 85, 173, 179, 180.
Goshawk, 87.
Grasshopper, 74.
Graves, H. S., 83.
Grayback, 129.
Greenback, 129.
Greenfish, 60, 67, 68, 208.
Grinnell, Joseph, 84.
Grizzly, 172.
Gros-bec, 90.
Grouse, 26, 29, 85; in Sequoia National Forest, 98.
Red, 86.
Sierra, 98.
Grunion, attempt to rear, 156; the spawning of, 201.
Guernsey, Chas., 78.
Guest, E. A., out fishin', 144.
Gull, 87.
California, 74.
Herring, 204; is it insectivorous?, 71–74.
Sea, 72.
Gun Club, 85, 176, 178.

H

Hæmulidæ, 59, 65, 66.
Hake, 44, 100, 164, 166, 208.
Half-moon, 60, 68.
Halibut, 33, 43, 44, 50, 56, 100, 145, 147, 154, 158, 164, 166, 208; eats large rock, 157–158.
California, 157.
Hardhead, 100, 112, 164, 166, 208.
Harvey, A. C., 124.
Hatchery, 23, 30, 37, 41, 79, 91, 109, 113, 146, 176, 178, 180, 196; department notes, 92, 151; department moves, 194; New York opens new, 204.
Almanor, 39, 92, 152.
Bear Lake, 39, 92, 152, 153.
Brookdale, 39, 75, 92, 151, 152.
Clear Creek, 39, 146, 152.
Cottonwood Lakes, 37, 152.
Domingo Springs, 38, 92, 146, 151, 152.
Fall Creek, 93, 151, 152.
Feather River, 38, 39.
Fort Seward, 38, 92, 146, 151, 152.
Kaweah, 146, 151, 152, 153, 195.
Klamath, 39, 152.
Marlette-Carson, 131, 134, 151.
Mount Shasta, 37, 38, 92, 93, 151, 152, 181, 185.
Mount Tallac, 38, 92.
Mount Whitney, 37, 38, 75, 92, 151, 152. 181, 193.
Pine Creek, 74.
Price Creek, 75.
San Mateo, 151.
Scott Creek, 92, 151.
Snow Mountain, 92, 151, 152.
Tahoe, 38.
Ukiah, 38, 92, 151.
Wawona, 39, 151, 152.
Yosemite, 93, 151, 152, 153, 195.
Heath, Harold, 182.
Hedderly, E. L., 188.
Helgramite, 139.
Henshaw, H. W., 122.
Herms, Prof., 143.
Herring, 3, 10, 11, 13, 15, 41, 44, 53, 57, 58, 73, 91, 100, 145, 147, 162, 164, 166, 182, 201, 208; and herring-like fishes of California, 182.
Greenback, 204.
Lake, 105, 204.
Heron, Night, game in Louisiana, 90.
Black-crowned Night, 90.
Yellow-crowned Night, 90.
Herzinger, E. L., pheasants damage crops in Inyo County, 99.
Higgins, Bert, 26.
Higgins, Elmer, 95, 96, 156, 182; goat fish taken in California, 156; spiny lobster larvæ, 156; attempt to rear grunion, 156; life history of flatfish, 157; porpoise captured, 157; two rare fishes, 203.
Hippoglossus, 157.
hippoglossus, 43.
Hippoglossina stomata, 157.
Hippoglossoides platessoides, 21.
Hjort, John, 201.
Holder, C. F., 137, 203.
Hook, 105, 139, 198.
Hubbs, C. L., 182; the stickleback: a fish fitted as mosquito destroyer, 21–24.
Hudson, C. B., 113, 126.
Hunter, J. S., 193.
Hunter, 29, 32, 34, 36, 42, 77, 78, 82, 84, 90, 97, 98, 172, 178, 181, 190, 194.
Market, 36, 78, 79, 91, 180.
Hunting, 31, 33, 36, 42, 81, 86, 172, 184, 204.
Accident, 30.
License, 81.
License law, 76.
Market, 36.
Hybrid, 132.
Hypomesus pretiosus, 203.
Hysoperta guttulata, 157.

I

Ibis, 85.
Ichthyologist, 112.
Illinois sportsmen dissatisfied, 97.
Importation, of quail from Mexico, 88–89.
Inconnu, 105.
Information, is needed, 81.
Interbreed, 57, 121.

J

Jackrabbit, 143.
Blacktailed, 142.
Jacobson, W. O., blackbirds and rice, 99.
Jellyfish, 95.
Jewfish, 60, 62.
Johnny Verde, 60, 63, 64.
Johnson, Hiram W., 178, 183.
Jordan, D. S., 124, 137, 139, 203.
Jotter, E. V., the coyote as a deer killer, 26–29.
Junk, Chinese, 3, 4, 5, 10.

K

Kelly, H. L., 32.
Kelp, 39, 40, 183; harvesting may be resumed, 197.
Key to California species of trout, 111.
Killifish, 21.
Kingfish, 13, 14, 15, 20, 33, 44, 100, 154, 164, 163, 166, 208.
King-of-salmon, 95, 158.
Koppel, I. L., our fur resources, 149.
Kyphosidæ, 59, 67.
Kytka, Theodore, 99.

L

Ladyfish, young discovered, 158.
Lagenorhynchus obliquidens, 157.
Larus argentatus, 72.
Laner, 87.
Laneret, 87.
Law, 76, 180, 187, 188, 192, 201, 204; proposed change of shrimp would menace fish life, 94.
Fish and game, 30, 78, 176, 178.
Game, 30, 31, 79, 81, 82, 88, 89, 192; to be enforced in national forests, 79; will be modified to agree with federal, 31.
Spiked buck, 30.
Migratory bird, 89, 191; conviction made under, 78; additional needed, 192.
Laws, G. O., deer increasing in Trinity Game Refuge, 98.
Legislation, 2, 88, 85; pending, 76.
Leopard, 82.
Lepomis cyanellus, 22.
Leuresthes tenuis, 156, 201, 203.
Life history, of flatfish, 157.
Life history notes, 42–43, 98–99, 160–161, 204–205.
Lincoln, R. P., summer on the California trout streams, 136–141.
Line, 6.
Linnet, 88, 99.
Lion, Mountain, 26, 29, 34, 78, 79, 82, 91, 149, 160, 172, 195, 206; many killed, 148.
Sea, 98.
Lobster, Spiny, 45, 101, 164, 167, 209; early stages of, 24–25; larvæ, 156.
Louvar, the occurrence of, 202–203.
Ludlum, R., 78.
Lure, 140.
Lutra canadensis pacifica, 98.
Luvarius imperialis, 203.
Lynx cromicus californicus, 160.

M

M., R. L., California, 192; some notes on dry-fly fishing, 169–170.
Mackerel, 33, 44, 100, 145, 146, 147, 162, 163, 164, 166, 200, 208; and mackerel-like fish, 59, 182.
Frigate, 203; recurrence of, 200.
Maintain a supply, 146.
Maley, J. T., 78.
Mallard, the food of, 87.
Mallotus villosus, 203.
Malma, 129.
Mammal, 181, 182.
Game, 182.
Manicure the bird-catching cat, 82–83.
Marlin-spike Fish, 208; used as food, 43.
Maule, W. M., deer hunting poor in Mono County, 98.
McAllister, M. H., elk in Shasta County, 98; game conditions in southern California thirty-five years ago, 172–173.
McAtee, W. L., 87.
McCarthy, Eugene, 135.
McLean, D. D., wildcat eats birds, 160.
McClond, George Jr., 38.
Meadowlark, 182.
Medialuna californiensis, 60, 68.
Menticirrhus undulatus, 14, 17, 18.
Meyers, J. P., 78.
Migration, 41, 55, 58, 85, 95, 98, 117, 128, 157, 159, 192; how do birds find their way?, 83–84.
Migratory bird treaty act, 30, 31, 32, 36; conviction made under, 78; constitutional, 190–191.
Mills, G. T., 124.
Milt, 33.
Mink, 83.
Minnow, 129.
Mite, 143.
Mole, 149; eats angleworms, 99.
Mollusk, 45, 87, 96, 101, 132, 133, 146, 164, 167, 182, 209.
Moran, Nathan, nesting of the band-tailed pigeon, 160.
Mosquito, the stickleback a destroyer of, 21–24.
Mountain Lion, *see* Lion.
Mountain Sheep, 31, 172.
Mouse, 82.
Mullet, 44, 100, 164, 166, 208.
Muskrat, 150.
Mussel, 45, 101, 164, 167, 209.
Namaycush, 133.
National Association of Audubon Societies, 71.
National forest, 83, 184; game laws to be enforced in, 79; deer in, 206.
Angeles, 34.
California, 207.
El Dorado, 33, 207.
Klamath, 33, 207.
Santa Barbara, 207.
Sequoia, 81; grouse in, 98.
Shasta, 207.
Sierra, 81, 207.
Stanislaus, 207.
Tahoe, 33.
Trinity, 207.

N

Naturalist, 189.
Nature guide, 189.
Nature Study League, 76, 145.
Field excursion, 188.
Neale, George, 78, 190.
Nelson, E. W., 83.
Nemastistius pectoralis, 159.
Ncomænis, 158.
Nest, 85, 160, 204.
Net, 2, 5, 6, 7, 10, 41, 71, 159, 196, 201; new fish, 41.
Dip, 90.
Gill, 196, 199.
Lompara, 41.

Purse-lompara, 41.
Round Haul, 203.
Sardine, 158.
Shrimp, 1, 2, 3, 7, 94.
Tow, 156.
Trawl, 94.
Newbert, F. M., 178, 180.
Newsome, J. E., 79.
Nidever, H. B., 3, 4, 94, 188.
Nielsen, E. M., 158, 203; fresh fish used at reduction plants, 154.
Note, on artificial propagation of spiny lobster, 70–71; on dry-fly fishing, 169–170; on habits and use of small crab, 171–172.
Commercial fishery, 39–41, 93–94, 154–156; 196–200.
Hatchery, 37–39, 92–93, 151–153.
Life history, 42–43, 98, 160–161, 204–205.
State fisheries laboratory, 94–96, 156–159, 200–204.
Notemigonus crysoleucas, 22.

O

Opal Eye, 69, 67.
Opossum, 149.
Osmerus thaleichthys, 9.
Otolith, 55, 56.
Otodectes cynotis, 143
Otter, Pacific River, 98.
Out fishin', 144.
Oyster, 45, 101, 164, 167, 198, 209.

P

PACIFIC FISHERMAN, 96.
Packer, 40, 154, 155.
Paladini, A., 1, 150.
Palmer, T. S., 84.
Pampano, 44, 100, 159, 164, 166, 202, 208.
Pampanito, 159.
Panulirus interruptus, 24, 70.
Paralabrax clathratus, 60, 63.
maculatofasciatus, 60, 64, 65.
nebulifer, 60, 63, 64.
Paralichthys californicus, 157.
Parasite, which affect food value of rabbits, 142–143.
Parcel post, shipments of game, 30.
Parophrys vetulus, 157.
Parr-mark, 109, 113, 122, 123, 125.
Partridge, 86.
Patterson, A. D., 189.
Pearson, A. G., 197.
Pelt, 35.
Perch, 44, 68, 100, 164, 166, 183, 208.
Sacramento, 2.
Yellow, 59.
Permit, federal, 32.
Pez de Gallo, 159.
Pheasant, 179; damage crops in Inyo County, 99.
English, 86, 87.
Ring-necked, 91.
Phyllosome, 24, 25, 70, 71, 156.
Pig, 26, 28.
Pigeon, 85.
Band-tailed, nesting of, 60.
Carrier, 83.
Homing, 83.
Passenger, reported in eastern states, 86.
Pike, 44, 100, 164, 166, 208.
Pintail, banded taken in Alameda County, 43.
Plaice, 51.
Plath, O. E., 88.
Plenary powers, 76; Fish and Game Commission needs, 30.
Pleuronectidæ, 157.
Pleuronecthys verticalis, 157.
Plover, 85.
Plumage, 90.
Poison, 43, 95, 191, 195.
Pollution, 177, 183.
Pomfret, 203.
Pope, Saxton, bear hunting with bows and arrows, 69–70.
Porcupine, is it worth saving?, 82.
Porpoise, captured, 157.
Pratt, G. D., 81.
Predatory animal, 26, 27, 29, 81, 83, 182.
See, also, Bird and Mammal.
Preserve, 82.
Game, 176, 178.
Propagation, 85, 204.
Protection, 87, 97.
Punnett, J. M., 98.
Purse-seine boat, 155.

Q

Quail, 26, 27, 29, 36, 69, 85, 88, 172, 179; importation from Mexico, 88–89.
Valley, with egg in December, 98.
Queenfish, 13, 14, 15.

R

Rabbit, 42, 69, 76, 142; parasites which affect the food value of, 142–143.
Brush, 142, 143, 179.
Cottontail, 142, 179.
Jack, black-tailed, 142.
Rail, 85.
Rainbow, *see* Trout.
Ranger, co-operate with game wardens, 206.
Ray, 182.
Recreation, 192.
Redfish, 127, 128.
Red Snapper, 158.
Refuge, game, 30, 36, 42, 76, 83, 177, 182, 184, 194, 195; notes on the new, 33; in Minnesota, 204; Quebec establishes, 204.
1*d*, 98.
1*e*, 150.
1*k*, 81.
Pinnacles Monument, 182.
Trinity National Forest, 26, 28, 182; deer increasing in, 98.
Report, California fishery products, 44–45, 100–101, 162–167, 208–209.
Expenditures, 47–48, 102, 211–212.
Number of deer killed, 104.
Violations, 46, 103, 210.
Seizures, 46, 103, 207.
Reptile, 101, 164, 167.
Reservation, 150.
Rice, 76; federal permit protects from ducks, 36; and blackbirds, 99.
Rich, Willis, 182, 185.
Rigdon, E. S., 31.
Roadrunner, 181.
Robin, 99.
Western, 160.
Roccus lineatus, 61.

Rock Bass, *see* Bass.
Rock Cod, *see* Cod.
Rockfish, 44, 100, 145, 164, 166, 208.
Rod, fly, 75, 136.
  Bait, 110.
Rodent, 74.
Roe, 159.
Roncador, 13.
Roncador stearnsi, 14, 18.
Roosevelt, President, 123.
Rooster Fish, 159.
Rutter, Cloudsley, 153.

S

Sablefish, 33, 162, 163.
Salachini, 163, 198.
Salmo, 106.
  agua-bonita, 108, 111, 119, 123, 124, 139.
  aquilarum, 11, 118.
  clarkii, 108, 111, 116.
  evermanni, 109, 111, 117, 118.
  furio, 109, 111, 131, 132.
  gairdneri, 111, 112, opp. 112.
  gilberti, 108, 111, 118–119.
  henshawi, 108, 111, 129.
  iridens, 107, 111, opp. 112, opp. 114, 118, 136.
  nelsoni, 109.
  lewisensis, 132.
  mykiss, 127.
  purpuratus henshawi, 127.
  regalis, 108, 111, 128.
  rivularis, 112.
  roosevelti, opp. 105, 108, 111, 119, 124–127, 139.
  shasta, 108, 111, 115–116.
  stonei, 108, 111, 116.
  tahoensis, 111, 127–128.
  trutta lewisensis, 109, 111, 132–133.
  whitei, 108, 111, 119, 121–122.
Salmon, 10, 11, 33, 34, 40, 44, 51, 91, 100, 105, 106, 112, 113, 114, 115, 134, 145, 146, 147, 148, 153, 162, 163, 164, 166, 177, 179, 182, 198, 208; long run of, 90; need more protection, 196–197, at Monterey, 198; Sacramento run of, 199; catch large at Fort Bragg, 199.
  King, 198.
  Quinnat, 37, 38, 39, 93, 150.
  Silver, 198.
  Sockeye, 55, 58, 90.
  Trout, 112.
Salmonidæ, 105, 106.
Salvelinus, 107.
  fontinalis, 109, 111, 129, 130–131, opp. 130.
  parkei, 129–130.
Sand Bass, *see* Bass.
Sand dab, 44, 95, 100, 145, 146, 157, 164, 166, 208.
Sanders, J. H., deer captured in Lake Tahoe, 205.
Sandpiper, 85.
Sardine, 39, 40, 41, 45, 80, 93, 94, 96, 101, 145, 147, 154, 155, 158, 159, 162, 163, 164, 167, 182, 198, 203, 208; note on the, 21; locating by aeroplane, 41; breeding season of, 159; run at Monterey, 197.
Sargo, 60, 65, 66.
Scale, 55.
Scapanus latimanus latimanus, 99.
Schaellle, Ernest, 178, 180.
Schmitt, W. L., 182; early stages of the spiny lobster, 24–25.
Sciaena saurna, 14, 19.
Scientific collector, permit, 32.
Scofield, N. B., 7, 8, 11, 146, 154, 182, 183, 185; shrimp fisheries of California, 1–12; the 1918 catch of fish, 145–146.
Scomber, 209.
Screen, 76, 97, 178, 184.
Scripps Institution for Biological Research, 24, 70, 183.
Sculpin, 12, 45, 101, 164, 167, 208.
Sea Bass, *see* Bass.
Sea Lion, 98.
Seal, Fur, 35.
Season, 150, 159, 173, 190; now begins, 78.
  Closed, 3, 30, 82, 89.
  Open, 91, 99.
Seaweed, as food, 198.
Seine, 2, 23, 155, 156, 196.
  Purse, 201.
Sellmer, W. B., 79, 188.
Seriola, 159.
Seriphus, 13.
  politus, 14, 15.
Serranidæ, 59, 61, 64.
Shad, 3, 10, 11, 33, 45, 101, 145, 146, 179, 183, 208.
Shark, 33, 154; of California, 182.
Shebley, F. A., 75, 183.
Shebley, W. H., 75, 92, 133, 135, 151, 180, 183, 185, 194.
Sheep, 26; *see* Mountain Sheep.
Sheepshead, 101, 164, 209.
Shock, W. T., 27, 28.
Shockley, W. W., 124.
Shooting, spring, 89, 97, 190.
Shotgun, 77.
Shrimp, 45, 101, 147, 164, 167, 183, 209; fisheries of California, 1–12; proposed change of law menaces fish life, 94.
Shands, Henry, 201.
  Siliqua, 175.
Skate, 33, 45, 101, 164, 167, 209; and rays of California, 182.
Skipjack, 45, 101, 145, 146, 162, 163, 164, 167, 200, 203, 204, 209.
Slug, 99.
Smelt, 3, 9, 10, 11, 12, 44, 100, 164, 166, 203, 209.
  Little, 156.
Smokehouse, 148.
Snail, 99, 209.
  Sea, 101, 164, 166.
Snipe, 85.
Snyder, J. O., 110, 116, 117, 128, 129, 135, 150, 182, 185, 197; breeding of fulvous tree-duck in Santa Clara County, 43.
Sole, 2, 10, 33, 44, 100, 145, 146, 209.
  Lemon, 157.
  San Diego, 157.
  Tongue, 157.
  Soleidæ, 157.
Sparrow, English, 99.
  Nuttall, 88.
Spawn, 42, 106, 115, 127, 131, 134, 139, 177, 196, 197, 199.
Spear, 76.
Spinner, 139.
Spiny Lobster, *see* Lobster.

Splittail, 164, 167, 209.
Spoon, 112, 129.
Sporozoa, 143.
Sport, 69, 75, 77, 146.
Sportsman, 78, 84, 85, 89, 95, 97, 150, 189, 191, 192; dissatisfied, 97; Washington forms state association, 204.
Spot, 18.
Squaretail, 94.
Squid, 45, 101, 164, 167, 209; at Monterey, 198.
Squirrel, 69; ground of California, 87.
  Tree, 149.
Starks, E. C., 158, 182, 203; fishes of the croaker family, 13–20; note on the sand dab, 21; rare fish from Monterey Bay, 43; marlin-spike fish used as food, 43; basses and bass-like fishes, 59–68.
State Fair, exhibit, 193.
Steelhead, *see* Trout.
Stercolepis gigas, 60.
Stevens, A. C., 124.
Stevens, S. V., 124.
Stickleback, as a mosquito destroyer, 21–24.
Stingaree, 164, 167, 209.
Stinnett, L. J., 37, 151.
Stomach examination, 86.
Stone, Livingstone, 135.
Sturgeon, 2, 45, 101, 164, 183; to be protected in other states, 160.
Stylopthalmus paradoxus, 95.
Sucker, 45, 100, 164, 166, 209.
Sunfish, 22, 60, 149.
  Blue-gill, 179, 193.
  Green, 22.
Surf-fish, 45, 101, 164, 166, 209; day and night of California, 203.
Surf-smelt, 203.
Surmullet, 156.
Swan, 85.
  Whistling, 91, 191.
Swordfish, 43, 45, 101, 164, 209.
Symphurus atricaudus, 157.

T

Tackle, 137.
Tahoe Public Camp, 189–190.
Tapeworm, 143.
Taylor, W. P., a suggestion for California conservationists, 84.
Terrapin, 101, 164, 167, 209.
Tetragonurus cuvieri, 94.
Tetrapterus nutsukurii, 43.
Thalcichthys pacificus, 203.
Thompson, Will F., 95, 96, 156, 158, 159, 182; conservation of our fisheries, 49–59; halibut eats large rock, 157–158; young of the ladyfish discovered, 158; clam investigation, 158; shad caught at Seal Beach, 158; Alaska black cod taken near San Pedro, 158; canuery receives Mexican fish, 158–159; the breeding season of the sardine, 159; recurrence of the frigate mackerel, 200; spawning of the grunion, 201; contributions to Canadian biology, 201; blue-finned and yellow-finned tuna, 201–202; the occurrence of the louvar, 202–203; absence of the dolphin fish, 203; day and night surf-fishes of California, 203; occurrence of the albacore north of San Francisco, 203–204.
Thunnus macropterus, 155.
  thynnus, 156.
Tibbits, A. C., 203.
Tick, wood, 142.
Tiger, 82.
Titlow, J. O., 83; how do birds find their way, 83–84.
Tivela, 175.
Tænia serialis, 143.
Tomcod, 2, 10, 13, 20, 45, 101, 164, 167, 209.
Tommy, 127, 128.
Topminnow, 21, 24.
Towhee, brown, 88.
Trachinotus cuvieri, 94.
Trachypterus, 95.
Trap, 184.
Trapper, 79; California and their catch, 35.
  Fur, 150.
Trapping, 27, 42, 88, 207.
  License law, 35.
  License, 84.
Trawl, beam, 11.
  Net, 94, 150.
  Otter, 25.
Trawler, 196; Japanese, in nets of law, 94.
Trawling, 96, 198.
Treaty, more bird, needed, 80; additional needed, 192.
Tree-duck, bred in Santa Clara County, 42–43; breeding in Santa Clara County, 43.
  Fulvous, 42.
Troll, 114.
Trolling, 80.
  Spoon, 112, 129.
Trout, 116, 133, 164, 167, 177, 179, 180, 193, 198, 204, 207; California, 105–135; summer on the California trout streams, 136–141.
  Black, 127.
  Black-spotted, 37, 38, 39, 92, 127, 147, 153, 179.
  Brook, 112, 130, 134, 137.
  Brown, 88, 109, 111, 131, 132, 147, 152,
  Bull, 129.
  California, 112.
  Clark, 127.
  Columbia River, 127.
  Cutthroat, 108, 111, 113, 115, 127.
  Dolly Varden, 107, 108, 111, 115, 130.
  Eagle Lake, 111, 116, 118, 129
  Eastern brook, 37, 92, 107, 108, 109, 111, 129, 130, opp. 130, 133, 147, 152, 178.
  Evermann, 117.
  Gilbert, 119.
  Golden, 37, 38, 105, 108, 111, 119, 121, 123, 124, 126, 135, 137, 152, 179, 193, 195; prints of, available, 194.
    Agua bonita, 111, 119, 123, 138.
    Coyote Creek, 121.
    Of Little Kern, 108, 121.
    Golden Trout Creek, 124.
    Mount Whitney, 123.
    Soda Creek, 108, 119, 121.
    South Fork of Kern, 108, 119, 123, 124.
    Volcano Creek, 119, 121, 122, 124.
    Roosevelt, 108, 111, 119, 124, 125.
    White, 119, 121.
  Great Lakes, 133, 134.
  Kern River, 118, 121.

Hake, 108.
Loch Leven, 37, 92, 107, 109, 111, 132, 133, 147, 152, 179.
Mackinaw, 108, 109, 111, 133, 134.
Mountain, 112, 140.
Nelson, 109.
Nissue, 116.
Nissui, 116.
Noshee, 108, 111, 116.
Rainbow, 31, 37, 38, 39, 92, 107, 111, 112, 113, 114, opp. 114, 115, 116, 118, 120, 127, 136, 137, 138, 139, 140, 141, 147, 152, 179; acclimatized in Argentina, 146.
Gilbert, 108, 118.
Kern River, 111, 118.
McCloud River, 111, 115.
Shasta, 108.
Red-throated, 127.
Salmon, 112, 129.
San Bernardino, 117.
San Gorgonio, 109, 111, 117, 118.
Scotch, 132.
Sea, 13, 16, 45, 101, 164, 167, 208.
Shasta, 108.
Silver, 127, 128.
Royal, 108, 111, 128, 129.
Steelhead, 31, 36, 38, 39, 45, 92, 101, 106, 111, 112, opp. 112, 113, 114, 115, 147, 151, 153, 164, 167, 198, 209.
Stone, 108, 116.
Tahoe, 108, 111, 117, 127, 128, 129.
Von Behr, 131.
Trout, fry, 30, 38, 39, 93.
Black-spotted, 92.
Tuna, 43, 45, 80, 94, 101, 145, 147, 155, 162, 163, 164, 167, 198, 200, 203, 209; fishermen receive 20 cents for first, 156.
Bluefin, 145, 200, 209; and yellowfin, 201.
Leaping, 202.
Long-finned, 198.
Yellowfin, 145, 155, 163, 200, 209.
Turbot, 45, 101, 157, 164, 167, 209.
Turtle, 94, 162, 164, 167, 209.
Green, 70.

U

Umbrina roncador, 14, 17.
United States Biological Survey, 32, 43, 83, 84, 97, 182, 191, 207.
United States Bureau of Fisheries, 2, 24, 32, 83, 90, 92, 132, 146, 149, 196.
United States Department of Agriculture, 87, 88, 159, 183, 191.
Bureau of Animal Industry, 88.
United States Food Administration, 40, 187.
United States Forest Service, 195, 206.
Co-operation, 206, 207.
United States National Museum, 82.
United States Supreme Court, 36, 89, 97.
Upeneus dentatus, 156.

V

Van Dyke, Henry, 145.
Venison, 31.
Vermin, porcupine classed as, 82.
Violation, of fish and game laws, 46, 103, 209.
Violator, makes queer defense, 31; Nova Scotia uses new methods to capture, 35; Pennsylvania punishes, 205.
Vogelsang, C. A., 78.

W

Wallace, J. H., 192.
Walsh, J. F., 205.
Walton, Isaak, 112, 136, 141.
Warden, 36, 89, 177, 185, 194, 195; do detective work in New York, 97; needs deputy chief game warden, 191–192.
Game, 42, 187; rangers co-operate with, 206.
Waterfowl, 26, 78, 80, 81, 89, 91, 97; die from eating shot, 191.
Weakfish, 16.
Westerfeld, Carl, 180, 183, 185; reply to Eden resolution, 178, 185.
Wetmore, Alex, 32.
Weymouth, F. W., 158, 182; notes on the habits and uses of the small sand crab, 171–172; destruction of pismo clams by oil, 174–175.
Whale, 41; industry of Pacific coast, 80; sperm taken off Monterey, —.
Right, 80.
Whaling, station on Monterey Bay, 41.
Whistling swan, 91.
White, S. E., 123, 126.
Whitebait, 45, 101, 164, 167, 209.
White Fish, 45, 105, 134.
Whiting, California, 14, 17.
Wildcat, 149, 150; eats birds, 160.
Wildfowl, 89, 181.
Migratory, 80.
Wild life, 30, 34, 76, 77, 78, 81, 83, 84, 180, 182, 192; in relation to agriculture, 99; ownership of, 149.
Williams, Frank, 78, 79.
Windle, Ernest, 188.
Wolverine, 35.
Wood tick, 142.

X

Xenistius californiensis, 60, 66.
Xesurus punctatus, 159.
Xyrcrurys liolepis, 157.

Y

Yellowtail, 33, 45, 101, 145, 146, 162, 163, 164, 167, 202, 209.
Young, Arthur, 69.

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"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

Volume 5 Sacramento, January, 1919 Number 1

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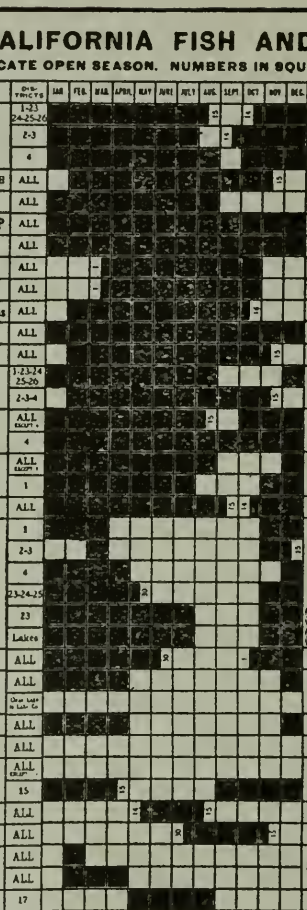
ABSTRACT CALIFORNIA FISH AND GAME LAWS

WHITE SQUARES INDICATE OPEN SEASON. NUMBERS IN SQUARES ARE OPEN DATES



	Dist. Tracts	BAG LIMITS, ETC.
DEER	1-23, 24-25-26	No Does, Fawns or Spike Bucks No sale of venison Two Bucks per season See Notes 1-2-8-9-10 on back of this abstract
	2-3	
	4	
RABBITS, COTTONTAIL AND BRUSH	ALL	15 per day. 30 per week
TREE SQUIRRELS	ALL	12 per season
ELK, ANTELOPE, MOUNTAIN SHEEP	ALL	KILLING OF ELK OR POSSESSION OF ELK MEAT A FELONY
SEA OTTER, BEAVER	ALL	$1,000 Fine for Sea Otter
BEAR, BLACK AND BROWN	ALL	SEE NOTE 11 ON BACK OF THIS ABSTRACT
FUR BEARING MAMMALS	ALL	SEE NOTES 10 11 ON BACK OF THIS ABSTRACT
Ducks, Geese, Jack Snipe, Mud Hens	ALL	SEE NOTES 4-14-15-17 ON BACK OF THIS ABSTRACT
RAIL, WOOD DUCK, WILD PIGEON SHORE BIRDS (Except Jack Snipe)	ALL	
QUAIL, VALLEY AND DESERT	ALL	15 per day. 30 per week
MOUNTAIN QUAIL	1-23-24-25-26	10 per day 20 per week
	2-3-4	
SAGE HEN	ALL EXCEPT 4	4 per day 8 per week
	4	
DOVE	ALL EXCEPT 1	15 per day
	1	
GROUSE	ALL	4 per day. 8 per week
TROUT (Except Golden) WHITEFISH	1	50 Fish or 10 Pounds and one Fish, or one Fish weighing 10 Pounds or over per day. In districts 2 and 3 during the winter season 5 fish per day
	2-3	
	4	
	23-24-25	SEE NOTES 25-38-40 ON BACK OF THIS ABSTRACT
	23	SEE NOTE 27 ON BACK OF THIS ABSTRACT
	Lakes	SEE NOTE 26 ON BACK OF THIS ABSTRACT
GOLDEN TROUT	ALL	20 per day. None under 5 inches
BLACK BASS	ALL	25 per day None under 7 inches NO SALE Hook and line only
	Owens Lake in Inyo Co.	
SACRAMENTO PERCH, SUNFISH AND CRAPPIE	ALL	25 per day. Hook and line only
STRIPED BASS, SHAD	ALL	SEE NOTE 24 ON BACK OF THIS ABSTRACT
SALMON	ALL EXCEPT 15	SEE NOTE 23 ON BACK OF THIS ABSTRACT
	15	
CATFISH	ALL	Closed season only for commercial fishing
CRABS	ALL	SEE NOTE 29 ON BACK OF THIS ABSTRACT
ABALONES — RED	ALL	SEE NOTE 34 ON BACK OF THIS ABSTRACT
ABALONES — GREEN, PINK, BLACK	ALL	
PISMO CLAMS	17	SEE NOTE 33 ON BACK OF THIS ABSTRACT

FOR LAWS IN FULL SEE PENAL CODE. FOR COMMERCIAL FISHING LAWS SEE MARKET FISHING ABSTRACT

DISTRICTS 1a, 1b, 1c, 1d, 1e, 1f, 1g, 1h, 1i, 1j, 1k, 1l, 2a, 3a, 3b, 3c, 3d, 4a, 4b, 4c, 4d, 4e, 4f, are game refuges. Hunting forbidden. Fishing in accordance with law relating to main district in which refuge is located. (See map.)

Hunting Licenses Residents, $1.00. Non-residents, $10; Aliens, $25. License year from July 1 to June 30

Angling Licenses Residents, $1.00; Non-residents, $3. Aliens, $3. License year from Jan. 1 to Dec. 31

Trapping Licenses from Fish and Game Commission

Trapping Licenses Citizens, $1.00; Aliens, $2.00. License year from July 1 to June 30

Hunting and Angling Licenses can be secured from Fish and Game Commission, County Clerks and License Agents

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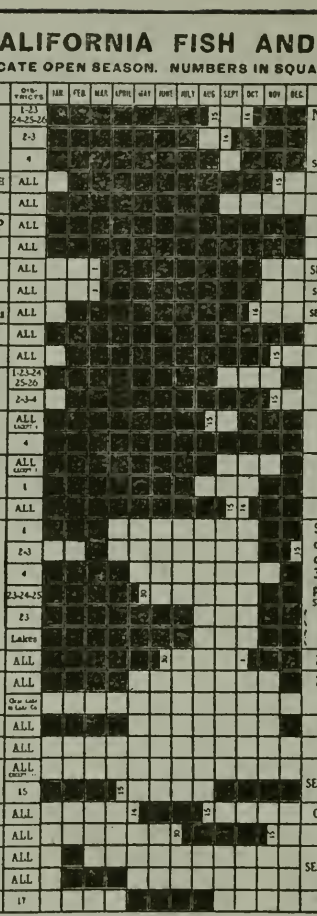
ABSTRACT CALIFORNIA FISH AND GAME LAWS

WHITE SQUARES INDICATE OPEN SEASON. NUMBERS IN SQUARES ARE OPEN DATES



FOR LAWS IN FULL SEE PENAL CODE FOR COMMERCIAL FISHING LAWS SEE MARKET FISHING ABSTRACT

DISTRICTS 1a, 1b, 1c, 1d, 1e, 1f, 1g, 1h, 1i, 1j, 1k, 1l, 2a, 3a, 3b, 3c, 3d, 4a, 4b, 4c, 4d, 4e, 4f, are game refuges. Hunting forbidden. Fishing in accordance with law relating to main district in which refuge is located. (See map.)

Hunting Licenses: Residents, $1.00. Non-residents, $10; Aliens, $25. License year from July 1 to June 30

Angling Licenses Residents, $1.00. Non-residents, $3. Aliens, $3. License year from Jan. 1 to Dec. 31

Trapping Licenses from Fish and Game Commission

Trapping Licenses Citizens, $1.00; Aliens, $2.00. License year from July 1 to June 30

Hunting and Angling Licenses can be secured from Fish and Game Commission, County Clerks and License Agents

CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

Volume 5 Sacramento, July, 1919 Number 3

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1919 ABSTRACT CALIFORNIA FISH AND GAME LAWS 1920

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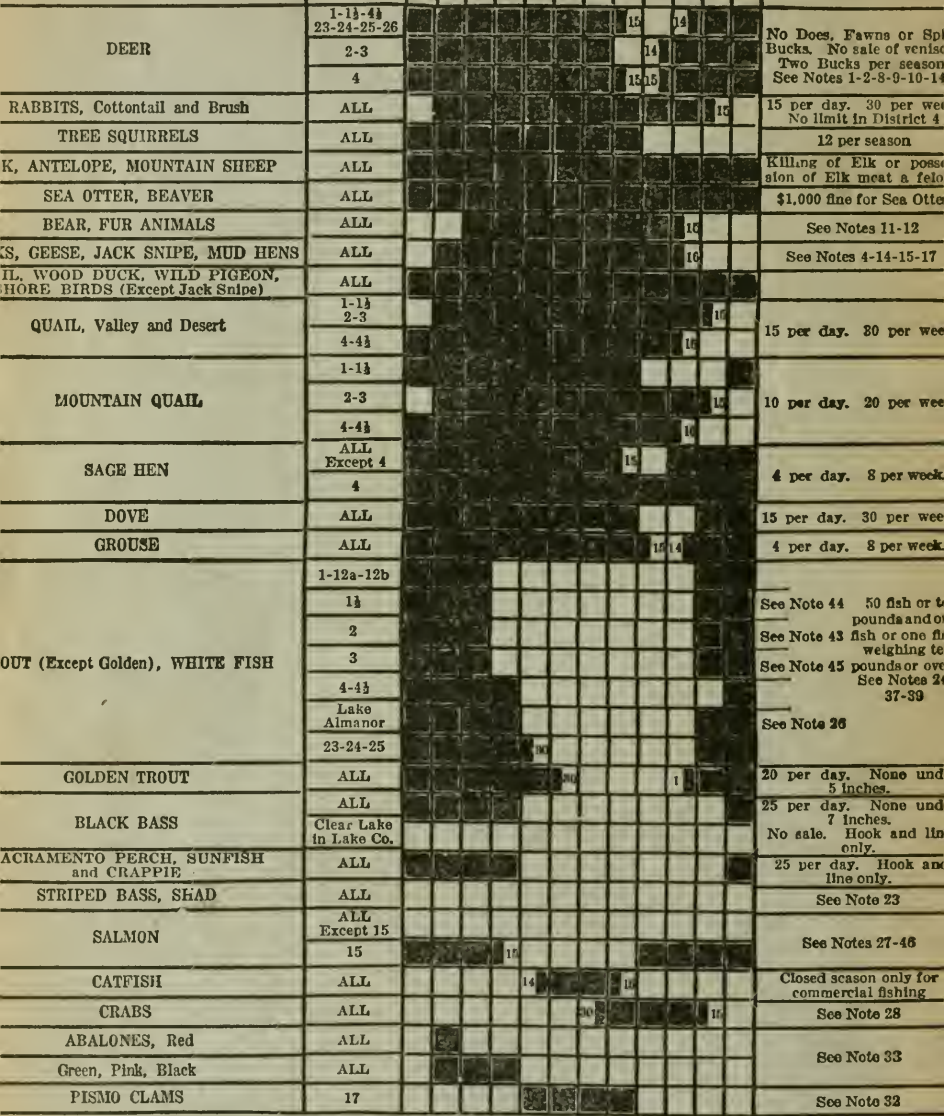

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